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OPTIMATION INC.

INSTRUCTION MANUAL

MODEL AC-126

ABSOLUTE AC-DC VOLTAGE CALIBRATOR

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DATE:

PRECISION AC INSTRUMENTS

OPTIMATION, INC. 9259 independence avenue, chatsworth, california 91311 882-6490
SUBSIDIARY OF JULIE RESEARCH LABORATORIES, INC.

OPTIMATION, INC.

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COVERED BY ONE OR MORE OF THE FOLLOWING PATENTS:

3,067,390
3,111,630
3,328,711
3,361,981.
3,382,461

OTHER PATENTS PENDING

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WARRANTY INFORMATION

WARRANTY

Optimation, Inc. warrants each instrument manufactured by us to be free from defects in material (except vacuum tubes, fuses and lamps) and workmanship. This warranty is valid for one year after delivery to the original buyer when the instrument is returned transportation prepaid, and after our inspection shows to our satisfaction that the instrument is defective. Our obligation under this warranty is limited to adjustment or service of any instrument returned to us for that purpose and replacement of defective parts (except as noted above). If the defect has been caused by misuse or improper operating conditions, this warranty is invalid. In this case, repairs can be made at a nominal charge, which we will quote before proceeding.

ANY DISCREPANCY DEVELOPS, TAKE THE FOLLOWING STEPS:

1. Notify Optimation, Inc. or our authorized representative in your area, giving full details of the malfunction. Include test data. If the question involves specifications, indicate the measuring instruments that were used for conducting the tests and the method of measurement. When we receive this data, service information or shipping instructions will be sent to you.

2. When you receive shipping instructions, send the instrument prepaid to us or the authorized repair facility designated in our instructions.

SHIPPING INFORMATION

This instrument should be inspected in accordance with the instructions in Section II as soon as it is received. If it does not operate or has been damaged in shipment, a claim should be filed with the carrier immediately. A complete report of the damage should be obtained from the claim agent and forwarded to Optimation, Inc. If this claim is not filed by you with the carrier, we will not be able to assist you in recovering the damage claim against the carrier. Upon receiving this report, we will advise you what to do with the instrument and arrange for repair or replacement. Be sure to include the model and serial number when referring to the instrument.

OPTIMATION INC.

MODEL AC-126 ABSOLUTE AC-DC VOLTAGE CALIBRATOR

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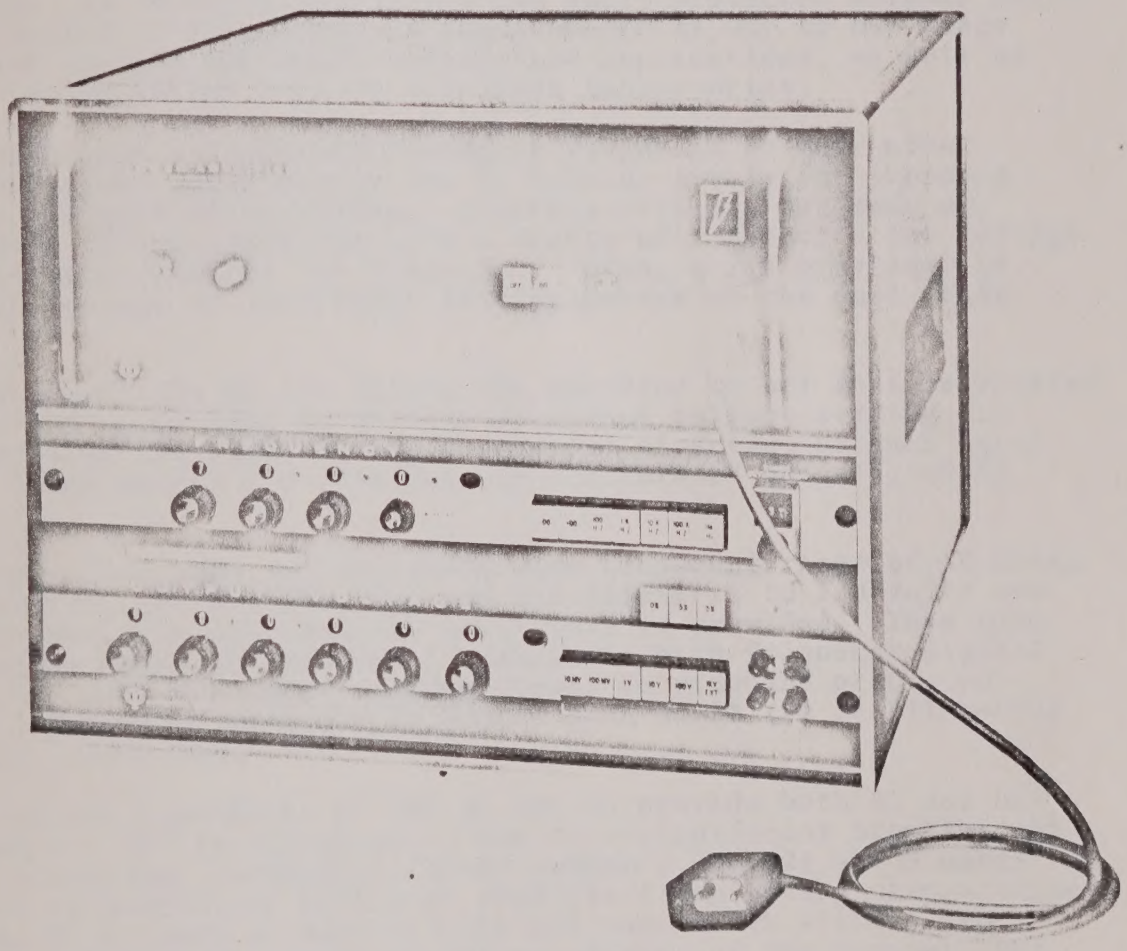

*ALL SOLID STATE-CONVECTION COOLED
*121 VOLTS BIPOLAR DC OR RMS
*1.1MHz FREQUENCY RANGE
*0.002% CALIBRATION ACCURACY FOR DC
*0.01% CALIBRATION ACCURACY FOR AC
*OPTIONAL AMPLIFIER EXTENDS VOLTAGE RANGE TO 1,200 VOLTS
*OPTIONAL AMPLIFIERS FOR CURRENT TO 100 AMPS WITH VARIABLE, CALIBRATED PHASE

Optimation's Model AC-126 represents the most innovative new voltage calibrator to be introduced in five years. While meter calibrators have been available, accuracies of these instruments are limited and AC voltages are only available at a few fixed frequencies. For high accuracy calibration, such as a digital voltmeter, it has been necessary to purchase separate instruments for DC and AC with the obvious disadvantages of high initial cost and high maintenance costs.

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MODEL AC-126 SPECIFICATIONS

The Model AC-126 is a highly stable source of both bipolar DC and AC voltages with setting accuracies of 0.002% for DC and 0.01% for AC. Rugged design, operational simplicity and fully protected outputs makes it ideally suited to the demanding requirements of day to day usage in production testing and meter calibration applications, as well as a secondary standard for primary standards laboratories.

Selection of output voltage and frequency ranges is by convenient lighted pushbuttons operating at low IC voltage levels for improved reliability and ease of operation. Discrete settings are made on direct reading in-line switches with 6 digits of resolution for voltage and 3 digits of resolution for frequency. Also, a 21% overrange is provided for voltage to facilitate testing meters at the full scale points.

Another feature of the AC-126 allows the operator to set in a calibrated offset error of up to ±5%, in percent of output voltage setting, to rapidly determine the error of any instrument directly, without interpolation. Three ranges are provided, 0% (calibrated output), ±0.5% and ±5%.

In the AC operating mode, an extremely wide frequency range of 10 Hertz to 1.1 Megahertz, to 12 volts rms, and 110 kilohertz to 120 volts rms (1,200 volts rms with external 1kV amplifier) is provided. This wide frequency range makes it possible to calibrate high frequency digital voltmeters and make frequency response tests on wideband precision amplifiers. Frequency accuracy is better than ±0.5% (to 10 kilohertz) with 3 digit resolution.

The highly unique capability of the AC-126 to provide both AC and bipolar DC outputs of high accuracy is due to a significant breakthrough in circuit technology covered by Patent Number 3,768,028 which makes possible the production of practical amplifiers exhibiting chopper-type stability at DC as well as state-of-the-art band width without the usual intermodulation and phase variation effects of the chopper-type amplifier. The ultra-flat response, zero output impedance and low distortion characteristics obtained with our patented circuit technique makes it possible to use individual DC coupled amplifiers to provide the 10, 100, and 1000 volt output ranges normally provided by a single AC amplifier with a tapped output transformer. Overall servoloops used with output transformer systems to maintain frequency response regulation and amplitude stability are not required. A DC coupled six digit amplitude attenuator is the final element which makes it possible to use either ±DC or AC input stimulus.

The overall benefits are a major reduction of complexity, faster settling time, better short term stability and improved reliability through use of far fewer components. Lower cost is achieved through reduced initial cost, lower maintenance costs and the peripheral benefits resulting from the added convenience of a smaller package and a simpler system, particularly when automatic programming is used.

Basic voltage range of the AC-126 is 121 volts bipolar DC or rms. The Optimation Model PA-226 Power Amplifier can be readily interconnected to extend the voltage range to 1,200 volts. Complete specifications for the PA-226 are given in a separate data sheet.

SPECIFICATIONS

OUTPUT, FRONT PANEL (AC AND DC)

VOLTAGE: 100 microvolts to 121.1110[1] volts bipolar DC or rms, in five decade ranges. May be set to zero, with 10 nanovolt resolution on lowest range.

SETTING RESOLUTION: 6 most significant digits, plus 20% overrange above 10 millivolts, in five decade ranges. Resolution is 1ppm of selected range.

REMOTE SENSING: 4 terminal output provides remote sensing on 1, 10 and 100 volt ranges.

OVERLOAD PROTECTION: 10 and 100 millivolt ranges fully protected against overloads or short circuits by current limiting. Recovery is automatic. 1, 10 and 100 volt ranges revert to "standby" operating mode if overloaded or shorted. Reset is by selecting any output voltage range.

OUTPUT CONFIGURATION: Isolated from chassis and AC line (floating) or grounded, front panel switch selectable.

OUTPUTS, REAR PANEL

REFERENCE PHASE: 5 volts rms, ±1%. Source impedance 0.5 ohm in series with 10 microhenries.

QUADRATURE PHASE: Constant 2.5 volts rms, ±2%. Source impedance 0.5 ohm in series with 10 microhenries. Provides quadrature reference for family of calibrated phase current sources.

PHASE ACCURACY: With respect to reference phase output; ±0.05 degree, 50 Hertz to 10 kilohertz. ±0.5 degree, 10 Hertz to 100 kilohertz.

FREQUENCY

RANGE: 10 Hertz to 1.099 Megahertz. 109.9 kilohertz on the 100 volt range.

ACCURACY: ±0.5% of setting, with vernier set to CAL position, to 10 kilohertz. ±1.0% to 1 Megahertz.

SETTING RESOLUTION: 3 most significant digits in 5 decade ranges. Vernier frequency control adjusts frequency ±1.5% of setting, with ±0.005% (50ppm) resolution, of setting.

STABILITY: ±0.01% (100ppm)/hour at a constant temperature.

TEMPERATURE COEFFICIENT: ±0.01% (100ppm)/°C.

AC AMPLITUDE SPECIFICATIONS

STABILITY, SHORT TERM: ±0.002% (20ppm)/24 hours.

STABILITY, LONG TERM: ±0.01% (100ppm)/6 months.

TEMPERATURE COEFFICIENT: ±0.001% (10ppm)/°C. of setting.

HARMONIC DISTORTION, FULL LOAD: 0.02%, 10 to 20,000 Hertz. 0.03%, 20 to 100 kilohertz. 0.25%, 0.1 to 1 Megahertz.

AC AMPLITUDE SPECIFICATIONS (continued)

ABSOLUTE AMPLITUDE ACCURACY[2]:

10Hz to 20Hz	±(0.05% + 5ppm of range + 10uV)
20Hz to 50Hz	±(0.02% + 5ppm of range + 10uV)
50Hz to 20kHz	±(0.01% + 5ppm of range + 10uV)
20kHz to 100kHz	±(0.05% + 5ppm of range + 10uV)
0.1MHz to 1MHz[3]	±(0.2% + 20ppm of range + 10uV)

MAXIMUM RESISTIVE LOADING:

0 to 121.1110mV	Internal impedance of output is less than 1 ohm. Typical load regulation for a 10 kilohm load is 0.01%.
0.1 to 1.211110V	40 ohms minimum.
1.0 to 12.11110V	1 to 2 volts, increase linearly 25 to 50 milliamps. 2 to 12 volts, 50 milliamps.
10 to 121.1110V	10 to 20 volts, increase linearly 25 to 50 milliamps. 20 to 121 volts, 50 milliamps.

MAXIMUM CAPACITIVE LOADING: 0 to 121.110 millivolts, no limit. 0.1 to 121.1110 volts, 5,000 picofarads to 10 kilohertz. 500 picofarads at 100 kilohertz.

REGULATION, LINE: ±10ppm for a ±10% change in the AC line voltage.

REGULATION, LOAD: No load to full load 1V, 10V and 100V ranges

10Hz to 20Hz	±0.01%
20Hz to 20kHz	±0.003%
20kHz to 100kHz	±0.01%
100kHz to 1MHz	±0.15%

10 and 100mV ranges source impedance is 1 ohm. Regulation is -0.01% with a 10 kilohm load.

DC SPECIFICATIONS

ACCURACY: (60 days)

10 & 100mV ranges	±(0.002% of setting + 1ppm of range + 5uV)
1 & 10V Ranges	±(0.002% of setting + 1ppm of range + 10uV)
100V Range	±(0.002% of setting + 1ppm of range + 100uV)

TEMPERATURE COEFFICIENT: ±(0.0002% (2ppm) + 1uV)/^{o}C.

OUTPUT CURRENT: 50 milliamperes above 1 volt with a maximum burden of 20 ohms below 1 volt.

LINE REGULATION: ±2ppm of setting or 10 microvolts for a ±10% change in the AC line voltage.

LOAD REGULATION: ±2ppm of setting or 10 microvolts, no load to full load.

DC INSTABILITY: Short term .03uV on mV ranges
3uV on 1 and 10 volt ranges
30uV on 100 volt range

SETTLING TIME: 500 milliseconds.

ERROR MEASUREMENT (AC AND DC)
RANGES: 0%, ±0.5% and ±5.0%.
ACCURACY: ±0.5% of selected error range.
RESOLUTION: Precision 5 turn direct reading potentiometer. Resolution, 0.07% of selected error range.

GENERAL
POWER REQUIREMENTS: 115 or 230 volts AC, ±10%, 50 to 60 Hertz. 130VA maximum. Line voltage switch selectable on rear panel.
DIMENSIONS, RACK MOUNTING: 7"H x 19"W x 18"D (177,8 x 482,6 x 457,2mm).
WEIGHT: Net, 38 lbs. (17,25kg). Shipping, 55 lbs. (24,97kg).
ACCESSORIES AVAILABLE: Bench mounting cabinet with 14" (355,6mm) of panel mounting space for AC-126 and PA-226 1kV Power Amplifier.

NOTES:

1. Optimation Model PA-226 1kV Power Amplifier extends the AC-126 voltage range to 1,200 volts bipolar DC or rms up to 100 kilohertz.
2. Accuracies stated include all calibration uncertainties in traceability to NBS; all effects of line voltage variations within stated limits; and effects of stability under Standard reference conditions of 23°C ±1°C and up to 70% RH. AC accuracy specifications also include effects of noise, cycle to cycle instability, and distortion in calibrating rms responding instruments.
3. 1 Megahertz to 12 volts only.

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TEXAS, San Antonio	DATA MARKETING ASSOCIATES, INC.	(512) 828-0937
WASHINGTON, Bellevue	SCIENTIFIC DEVICES-NORTHWEST	(206) 454-0900
WISCONSIN, Brookfield	PIVAN ENGINEERING CO.	(414) 786-1940

SECTION I

GENERAL INFORMATION

1-1. SCOPE.

1-2. This publication covers the Optimation, Inc. Model AC-126 Absolute AC Voltage Calibrator, with the exception of the optional PA-226 1kV Power Amplifier which is covered by a separate instruction manual.

1-3. GENERAL INFORMATION.

1-4. GENERAL DESCRIPTION. The Model AC-126 is an Absolute AC and DC Voltage Calibrator. Measurement error of the instrument under test is displayed, in percent, by front panel operating controls making it ideally suited for testing and calibrating meters, such as DVM's. Some of the more significant operating features are:

1. An absolute AC dial-in voltage accuracy ±(0.01% + 5ppm of range + 10 microvolts) over the midband frequency range of 50 Hertz to 20 kilohertz, and an absolute DC accuracy of ±(0.002% + 1ppm of range + 5uV).

2. Output voltages of up to 121 volts at DC and AC rms over the wide frequency range of 10 Hertz to 110 kilohertz and 12 volts rms to 1.1 Megahertz.

3. Short term frequency drift of less than ±100ppm.

4. Short term amplitude stability of better than ±20ppm for 24 hours.

5. Quadrature phase output of -90 degrees, ±0.05 degree from 50 Hertz to 10 kilohertz.

1-5. CALIBRATOR DESCRIPTION. The Calibrator contains the DC reference circuits, oscillator circuits, error determination circuitry, ladder attenuator, 10 volt amplifier and 100 volt power amplifier. Output frequency and amplitude are dialed-in on direct reading switches over the frequency range of 10 Hertz to 110 kilohertz and voltage range of 100 microvolts to 120 volts rms. Accuracy of the frequency setting is better than ±0.5%. A vernier control increases the resolution to better than 0.005% (50ppm)

of setting. Output voltage setting accuracy on AC over the midband frequency range of 50Hz to 20kHz is ±(0.01% + 5ppm of range + 10 microvolts) with 6 digit resolution plus overranging. Should power to the AC-126 be interrupted, an automatic standby operating mode shorts the output terminals when power is restored protecting operating personnel and preventing damage to the instrument being calibrated from unexpected overvoltage conditions.

1-6. SPECIFICATIONS.

1-7. The Model AC-126 is designed for continuous operation in a normal laboratory environment over the ambient temperature range of 0°C to 40°C. Within this range, the instrument will operate with the performance and accuracy specified in Table 1-1. Warm up time for the given performance is 90 minutes.

1-8. PREPARATION FOR RESHIPMENT.

1-9. Electronic calibration equipment and test instruments must be packed with special care. The shipping carton in which the Calibrator was originally packed is designed to provide maximum protection from adverse environments and from the shock and vibration incurred during shipment. It should be preserved and utilized for reshipment or subsequent storage whenever possible. When preparing the Calibrator for reshipment, ensure that the container is well sealed with strong tape or metal bands.

SECTION II

INSTALLATION

2-1. UNPACKING AND HANDLING.

2-2. The Model AC-126 is shipped in a single packing container. All of the accessories which are supplied are packed in the same container. Handle the instrument carefully when removing it from the shipping carton, using caution not to damage any of the front or rear panel operating controls or connectors.

2-3. POWER REQUIREMENTS.

2-4. The Model AC-126 is designed to operate from 115 volts, ±10%, or 230 volts, ±10%, single-phase AC, at a line frequency of 50 to 400 Hertz. The AC LINE selector switch located on the rear panel converts the Calibrator from one operating voltage to the other. To convert the instrument from 115 volts to 230 volts, move the slide switch with the tip of a screwdriver to the 230 volts position. Line fuses F1 and F2 do not have to be changed for 230 volts operation.

2-5. INSPECTION.

2-6. VISUAL INSPECTION. Inspect the Calibrator after unpacking for damage that may have occurred during transit. Check that there are no loose or broken knobs, bent or broken panel connectors, and dents or scratches on the cabinet surfaces. Specifically, the instrument should be visually inspected for the following items before placing it into operation:

1. Check that the front panel frequency and voltage selector switches can be rotated freely without binding and for smooth operation.

2. Remove the top cover by removing the 11 pan head screws.

3. Check that all socket mounted transistors and integrated circuits are properly seated.

4. Check that the lamps are not broken and are properly seated.

5. Check socket mounted potentiometers for proper seating.

6. Replace the top cover and 11 pan head screws.

7. Remove the bottom cover by removing the 11 pan head screws.

8. Check that the lamps are not broken and are properly seated.

9. Check that all potentiometers which are mounted in sockets are properly seated.

10. Replace the bottom cover and 11 pan head screws.

11. Check that the rear panel AC LINE switch is set to 115 volts unless the AC-126 is to be operated from 230 volts.

NOTE

If the Calibrator was damaged during shipment it must be reported immediately to the responsible carrier. A complete report of the damage must be submitted to the carrier's claim agent with a copy forwarded to Optimation, Inc. Unless this damage claim is properly filed, Optimation cannot be held responsible for any subsequent repair or replacement charges.

2-7. INSTALLATION REQUIREMENTS.

2-8. GENERAL. The Model AC-126 does not require any special installation procedures or cooling requirements except that some space should be provided above the slots in the top cover at the rear of the Calibrator to permit convection cooling.

2-9. INSTALLATION IN OPTIONAL CABINET. When the Model AC-126 is to be installed in the optional cabinet, use the following procedure:

1. Lay the cabinet down with the front facing up to facilitate mounting the instrument.

2. Place the Calibrator at the top of the cabinet by lowering it into position.

3. Mount the Calibrator using 4 black panel mounting screws provided.

NOTE

Space is provided in the cabinet for mounting the Model PA-226 1kV Power Amplifier. The amplifier must be mounted below the Calibrator as described in the PA-226 instruction manual.

2-10. INSTALLATION IN RACK CABINET. The AC-126 can be installed in any EIA standard 19 inch wide cabinet that has 7 inches of panel mounting space available. The procedure outlined above should be followed. Care must be taken to allow a minimum of 6 inches of clear space behind the instrument and at least 3 inches at the sides to permit proper circulation of air. The AC-126 is cooled by normal convection and does not require any additional cooling when installed in a well ventilated cabinet and operated within the temperature range.

CAUTION

When mounting the AC-126 in a cabinet the louvers in the top cover, rear, must not be blocked or possible damage may result due to the restriction of air flow.

2-11. CABLE ASSEMBLIES.

2-12. AC POWER CABLE. A separate 3 conductor electrical power cord is supplied with the AC-126 which connects to the rear panel AC INPUT receptacle. For the protection of operating personnel, the front panel and exterior cabinet surfaces are connected to the ground pin of the AC INPUT receptacle. If the instrument is to be connected to a 2 pin non-polarized electrical outlet, a 2-prong adapter must be used with the pigtail wire of the adapter connected to an adequate electrical ground.

2-13. OUTPUT LEADS. The front panel output connectors of the AC-126 are standard multiple use binding posts which will accept a double GR type banana plug, spade connectors or tin leads. GR type connectors are also provided on the rear panel for the fixed amplitude 5V ±0.25% AC/DC reference signal output. GR connectors are provided to monitor the 8.4V internal reference diode. A BNC connector is provided on the rear panel for the approximately 2.5V fixed amplitude quadrature phase output signal. It should be noted that the reference output is opposite in phase to the front panel output; that is, plus when the front panel output is minus and 180° out of phase on AC.

2-14. Two output cable assemblies are optionally supplied with the Calibrator. The four wire cable assembly (P/N 901383) is for general applications and should be used for the 1V, 10V or 100V ranges at frequencies of up to 1 Megahertz. On the 10mV and 100mV ranges where remote sensing is not used the two wire cable assembly (P/N 901382) should be used. Alternately, links connecting high output to high sense and low output to low sense may be used with a single shielded output cable. See Section 3-27 and 3-28.

2-15. INITIAL TURN ON AND CALIBRATION.

2-16. INITIAL TURN ON. Connect the Calibrator AC line cord to the power source. Depress the Calibrator POWER switch. The POWER, STANDBY, 0% and 1kHz lighted pushbuttons will illuminate indicating the operating modes which the Calibrator assumes when power is initially applied. Also a frequency decimal point will light. Refer to Section 3 for detailed operating instructions.

2-17. INITIAL CALIBRATION. All internal adjustments have been set at the factory and the Model AC-126 is calibrated to laboratory standards which are traceable to the National Bureau of Standards. The Absolute AC Calibrator is ready for use when received.

SECTION III

OPERATION

3-1. GENERAL.

3-2. The Model AC-126 is an Absolute AC and DC Voltage Calibrator which can be used for a wide range of applications. To make the most effective use of the system, the operation of all controls and the performance capabilities must be known. This section describes the operation of the controls and connectors, and contains general operating information for the Model AC-126.

3-3. The Model AC-126 can be operated where the ambient air temperature is between 0°C and 55°C. It can be stored in ambient air temperatures that are between -40°C and 75°C. After storage at temperatures that are beyond the normal operating limits, allow the chassis to reach the operating temperature limits before applying power to the system to prevent moisture condensation.

3-5. OPERATING CONTROLS AND CONNECTORS.

3-6. GENERAL. A brief description of the function and operation for each operating control and connector follows. Details operating instructions are given in paragraphs 3-9 and 3-13.

3-7. AC-126 FRONT PANEL.

1. FREQUENCY - Selector switches which set the 3 most significant digits (left-hand) of the frequency. The digit indicators display the selected frequency with the least significant (right-hand) digit fixed at zero.

2. VERNIER - Adjusts the frequency over a high resolution vernier range of approximately ±1.5% of setting.

3. K and HZ - Indicate the frequency setting is read in kilohertz (KHZ) or Hertz (HZ) when lit.

4. FREQUENCY RANGE - Illuminated pushbuttons which select + or - DC or the decade frequency range. Automatically positions the floating decimal point and lights the Hz or KHz indicators.

5. ON PUSH OFF - Illuminated pushbutton which controls the AC power to the Calibrator. Also controls the filament and low voltage power supplies in the 1KV Power Amplifier when used. Indicates power on when lit.

6. STANDBY - Lighted pushbutton which selects the STANDBY operating mode. When the STANDBY pushbutton is depressed any selected voltage range is cancelled, and the OUTPUT terminals are internally shorted. The Calibrator will also revert to standby if the 1V, 10V or 100V ranges are inadvertently overloaded or shorted.

7. ERROR RANGE - Lighted pushbuttons which select the ERROR DETERMINATION RANGE.

a. 0% - Output amplitude of the Calibrator is calibrated to the OUTPUT VOLTAGE switches setting.

b. 0.5% - The ERROR DETERMINATION potentiometer will adjust the output amplitude over a range of 0 to ±0.5% from the front panel OUTPUT VOLTAGE switches setting.

c. 5% - The ERROR DETERMINATION potentiometer will adjust the output amplitude over a range of 0 to ±5.0% from the front panel OUTPUT VOLTAGE switches setting.

NOTE

The output amplitude is calibrated to the front panel OUTPUT VOLTAGE switches setting only when the 0% error range is selected.

8. ERROR DETERMINATION - A direct reading five turn potentiometer which adjusts the output amplitude over the calibrated range as selected by the % ERROR RANGE lighted pushbuttons. Setting is read directly in percent. (.500 on 0.5% range, 5.00 on 5.0% range).

9. INDICATED ERROR - Selects either a positive (+) or negative (-) adjustment range for the ERROR DETERMINATION potentiometer.

10. M and V - Indicates that the voltage setting is read in millivolts (MV) or volts (V) when lit.

11. VOLTAGE RANGE - Lighted pushbuttons which select the decade range. Automatically positions the floating decimal point and illuminates the M and/or V indicator.

12. OUTPUT VOLTAGE - Selector switches which set the 6 most significant digits of the output amplitude. The digit indicators display the selected amplitude with the decimal point automatically positioned.

13. OUTPUT - Output terminals for the 10mV, 100mV, 1V, 10V and 100V ranges.

14. SENSING - Terminals for the remote sensing leads when the 1V, 10V or 100V ranges are selected.

NOTE

When the 10mV or 100mV ranges are selected the shorting links between the output and sensing terminals must be in place unless optional output cable assembly 901382 is used.

15. OUTPUT - A slide switch to select a floating or grounded output configuration of the OUTPUT terminals.

3-8. CALIBRATOR REAR PANEL.

1. TO PA-226 - Connectors for interconnecting the Calibrator and 1KV Power Amplifier.

a. J8 SIGNAL - Twinax or GR output connector for the Calibrator output signal to the 1KV Power Amplifier input.

b. J7 - AC line connector for the 1KV Power Amplifier high voltage power supply.

c. J9 CONTROL AND LOW POWER AC - Connector for the 1KV Power Amplifier low voltage power supply and control lines for activating the 1KV voltage range.

2. AC INPUT - AC-125 AC power input connector.

3. F1 and F2 - AC line fuses for the Calibrator. Both sides of the AC input are fused.

4. F3 - Spare AC line fuse.

5. J4, J5 DC REF - Test points for monitoring the internal DC reference diode voltage.

6. REF OUTPUT - Output banana jack connectors provide 5V ±0.25% DC or rms AC output depending on whether frequency or DC pushbuttons are actuated. Polarity and phase are reversed from front panel output. Instrument is factory calibrated to make rms AC voltage at 1kHz equal to ±DC within ±0.01%. (For use with absolute current sources, such as Model CS-110).

7. 90° OUTPUT - Output connector providing an approximate 2.5 volts rms quadrature phase signal output. Phase angle is 90° (lagging), $\pm 0.05^{\circ}$ 50Hz to 10kHz and $\pm 0.5^{\circ}$ 10Hz to 100kHz, with respect to the oscillator reference phase output signal. (For use with calibrated phase current sources such as Model QCS-110).

8. AMPTD CAL AC - Adjustment potentiometers for calibrating the absolute AC output amplitude.

a. 10V 1kHz - Adjusts absolute AC amplitudes at 1 kilohertz for frequencies between 10Hz and 100kHz.

b. 10V 1MHz Range - Adjusts absolute AC amplitude at 100 kilohertz, on the 1MHz frequency range for frequencies between 100kHz and 1MHz.

9. AMPTD CAL DC

a. 10V - Adjusts absolute amplitude at +10V.

b. ZERO - Adjusts DC offset on 1, 10, and 100V ranges with amplitude controls set at 0. It is recommended that the control be set for zero DC offset on the 1V range.

3-9. PRELIMINARY OPERATION.

3-10. GENERAL. The Model AC-126 does not require any special preliminary operational procedures. The following paragraphs are intended only as a guide and it is not necessary to follow any particular sequence when setting the front panel operating controls, with the exception of the 1KV voltage range.

3-11. INITIAL TURN ON - The following steps outline the procedure which should be followed when initially applying power to the Model AC-126.

1. Check that the rear panel AC line selector switch S30 is set to the correct position (110 or 230 volts) for the power source that will be used.

2. Depress the Calibrator POWER switch to on. The STANDBY, 0% and 1KHz pushbuttons will light indicating the initial operating modes selected when power is first applied.

3. The Model AC-126 is now ready for operation. To meet the specifications listed, a 1½ hour warm up period must be allowed after power is initially applied. If operation is attempted without sufficient warm up, the output amplitude and frequency will slowly drift and may exceed the given accuracy specifications.

3-12. OPERATION. The steps below demonstrate the correct procedure to be followed when setting the front panel operating controls for typical applications. Paragraph 3-13 gives detailed operating instructions for each of the front panel operating controls.

1. Select the desired FREQUENCY RANGE or (+) or (-) DC pushbutton.

2. If AC output is desired, set the desired output frequency on the FREQUENCY selector switches. Frequency is read directly on the digit indicators with the K and/or HZ indicator properly lit and the decimal point automatically positioned. Neither indicators or decimal point will be illuminated in the DC operating mode.

3. If the application requires an output frequency accuracy of better than ±0.5% calibrate the VERNIER frequency control as described in Paragraph 3-18.

4. Set the OUTPUT slide switch for either a floating or grounded output configuration.

5. Connect the load or meter to be tested across the OUTPUT terminals, using the proper output cables.

6. If remote sensing is desired, remove the shorting links between the OUTPUT and SENSING terminals. Connect the remote sensing leads between the SENSING terminals and the load as described in Paragraph 3-31.

NOTE

When the 10mV or 100mV ranges are selected the shorting links between the OUTPUT and SENSING terminals must be connected for local sensing.

7. Set the OUTPUT VOLTAGE switches for the desired output amplitude setting. The most significant figure of the desired amplitude must be set in the left-hand digit to meet stated accuracy specifications and for best resolution except when setting voltages of less than 1 millivolt.

8. Select the VOLTAGE RANGE for the desired output amplitude.

CAUTION

If the unit goes into STANDBY mode, check the output and sensing leads for proper connection and shorts. Also make sure that the load impedance/output voltage combination does not exceed the AC-126 output current specification. Instrument will go into standby when output current exceeds approximately 150mA on 1 and 10V ranges and 75mA on 100V range.

9. Set the ERROR DETERMINATION potentiometer to zero (fully counterclockwise). Note the reading on the meter being tested. If it is low set the INDICATED ERROR switch to minus, if it is high set the INDICATED ERROR switch to plus.

10. Select the 0.5% or 5% ERROR RANGE.

11. Adjust the ERROR DETERMINATION potentiometer until the meter under test reads the exact voltage set on the OUTPUT VOLTAGE switches.

12. Read the error (in percent) of the meter directly from the ERROR DETERMINATION potentiometer.

3-13. GENERAL OPERATION.

3-14. OUTPUT FREQUENCY. The AC-126 output frequency can be accurately set using front panel operating controls which eliminates the need for external frequency monitoring instruments for most applications. The three most significant digits of frequency are set on the FREQUENCY selector switches and the decade range is set by the FREQUENCY RANGE lighted pushbuttons. The VERNIER control varies the frequency over a narrow high resolution range for setting the frequency with an accuracy or resolution greater than can be obtained by the frequency selector switches. These controls and the accuracy of the Model AC-126 are described in the following paragraphs.

3-15. OUTPUT FREQUENCY ACCURACY. The frequency accuracy of the AC-126 is ±0.5% of the setting over the frequency range of 10 to 100,000 Hertz and ±1.0% of the setting from 100 kilohertz to 1 Megahertz when the VERNIER control has been calibrated as described in Paragraph 3-18. If the VERNIER control is not calibrated, the frequency accuracy will be better than ±2.0% of the setting. For applications which require an accuracy better than ±0.5%, the exact frequency can be set with the VERNIER control while monitoring the output on an external frequency counter.

3-16. DECADE FREQUENCY RANGES. Five decade ranges are provided to cover the frequency range of 10 Hertz to 1 Megahertz. The FREQUENCY RANGE lighted pushbuttons select the decade range, light the K and/or HZ indicator and positions the corresponding decimal lamp. To achieve the greatest accuracy and resolution, the lowest decade range where the desired frequency setting can be obtained should always be used. Table 3-1 shows the range of frequency settings for the decade frequency ranges.

3-17. DISCRETE FREQUENCY SETTING. The discrete frequency setting is made by the front panel FREQUENCY selector switches which set the three most significant digits of frequency. This provides for three digit resolution over the range of 10 Hertz to 1 Megahertz. The least significant digit (right-hand) is fixed at zero and the decimal point is automatically positioned so that the displayed frequency setting is always read directly in Hertz to kilohertz and does not require interpolation by the operator. The most significant digit (left-hand) cannot be set below "1" (internal mechanical stop) and frequency selection is always made with the most significant figure of the desired frequency set in this digit. Setting the frequency in this manner provides the maximum amplitude stability, lowest signal distortion and greatest resolution. This digit also has a tenth position for overranging convenience.

TABLE 3-1. DECADE FREQUENCY RANGES.

FREQUENCY RANGES	SETTING RANGE
100Hz	10.00 to (10) 9.90Hz
1kHz	100.0 to (10) 99.0Hz
10kHz	1000. to (10) 990.Hz
100kHz	10.00 to (10) 9.90kHz
1MHz	100.0 to (10) 99.0kHz

3-18. VERNIER FREQUENCY CONTROL. The VERNIER frequency control provides high resolution adjustment of frequency over a range of approximately ±1.5% of the frequency setting. For most applications where an output frequency accuracy of approximately 1% over the full frequency range is adequate the VERNIER frequency control can be set to and left in the calibrate position (knob pointer lined up with VERNIER dot at 3 o'clock position) and frequency can be set using the FREQUENCY and FREQUENCY RANGE controls only. The frequency accuracy will then be within ±0.5% over the midband frequency range 10 to 100,000Hz. For critical applications requiring a more precise setting of frequency VERNIER control can, of course, be set by the use of an external frequency counter. The digital reciprocal type of counter is the most convenient for frequencies below 10kHz. The resolution of the VERNIER control is approximately 0.005% (50ppm) of setting.

NOTE

Due to the poor input impedance linearity of some digital frequency counters, it is advisable to disconnect the counter from the calibrator output after frequency adjustments in order to eliminate the possibility of an increase of distortion due to non-linear loading.

3-19. OUTPUT AMPLITUDE. The Model AC-126 is an absolute AC/DC voltage source with amplitude directly set by front panel operating controls. This eliminates the need for external monitoring instruments, such as a Thermal Transfer Standard, when testing or calibrating instruments. The six most significant digits (plus overrange) of voltage are set on the OUTPUT VOLTAGE selector switches and the range is set on the VOLTAGE RANGE lighted pushbuttons. The following paragraphs describe the operation of these amplitude controls and the accuracy of the Model AC-126.

3-20. OUTPUT AMPLITUDE ACCURACY.

a. *AC - Accuracy of the output amplitude is as follows:

10Hz to 20Hz	±(0.05% + 5ppm of range + 10uV)
20Hz to 50Hz	±(0.02% + 5ppm of range + 10uV)
50Hz to 20kHz	±(0.01% + 5ppm of range + 10uV)
20kHz to 100kHz	±(0.05% + 5ppm of range + 10uV)
0.1MHz to 1MHz	±(0.2% + 20ppm of range + 10uV)

For further data refer to the specifications in Section 1.

b. DC - Accuracy of the output amplitude as as follows:

10 & 100mV ranges	±(0.002% of setting + 1ppm of range + 5uV)
1 & 10V Ranges	±(0.002% of setting + 1ppm of range + 10uV)
100V Range	±(0.002% of setting + 1ppm of range + 100uV)

For further data refer to the specifications in Section 1.

3-21. OUTPUT VOLTAGE RANGES. Five decade ranges are provided which cover the output amplitude range of 100 microvolts to 121.1110 volts rms and are selected by the VOLTAGE RANGE lighted pushbuttons. The 1MHz frequency range is limited to 12 volts rms and the calibrator will revert to the "STANDBY" mode if the 1MHz and 100V ranges are simultaneously selected. The selected range automatically positions the floating decimal point and lights the M and/or V indicator. The lowest decade range where the desired output voltage setting can be obtained should always be used to achieve the greatest accuracy and resolution for the setting. Table 3-2 shows the voltage settings for the decade ranges.

3-22. DISCRETE AMPLITUDE SETTINGS. Six decades of voltage attenuation (plus overrange) can be directly dialed-in on the OUTPUT VOLTAGE ladder attenuator switches. The decimal point is automatically positioned and the voltage setting is always read directly in volts or millivolts without any additional interpolation. Each switch is an 11 position (0 through 10) rotary switch except for the most significant digit which has 12 positions (0 through 11). The additional tenth and eleventh positions provide a convenient overrange since a large number of measurements made when calibrating meters are at the full scale points. When a ten (10) is set on one of the digits a one must be added to the digit immediately to the left. For example, the following setting has a 10 dialed into the 4th digit: 1.36(10)72 and is read as 1.37072. Voltage selection must always be made with the most significant figure of

*These accuracy specifications include the effects of short term instability, cycle-cycle instabilities, calibration uncertainties as specified by NBS, noise and distortion when calibrating average or rms responding instruments at 25°C, ±2°C.

TABLE 3-2. DECADE VOLTAGE RANGES.

RANGE	VOLTAGE SETTING RANGE
10mV*	0 to (12).11110mV
100mV	10.0000 to (12)1.1110mV
1V	.100000 to (1.2)11110V
10V	1.00000 to (12).11110V
100V	10.0000 to (12)1.1110V
1KV EXT**	100.000 to (12)11.110V

*Accuracy specs apply only above 100uV.
**With external 1KV Power Amplifier only.

the desired output voltage set in the extreme left-hand digit except when a setting of less than 1 millivolt is desired. Setting the amplitude in this manner will provide the maximum amplitude stability and best resolution. The output can be reduced to zero by dialing in all zeroes or by selecting the STANDBY operating mode.

3-23. ERROR DETERMINATION CONTROLS. The error of the AC instrument being tested can be rapidly determined by using the error determination operating controls. The following paragraphs describe the use and operation of these controls.

3-24. % ERROR RANGE. Three % ERROR RANGE lighted pushbuttons select the error range of 0%, 0.5%, or 5.0%. This sets the range over which the output amplitude can be varied from the front panel setting with the ERROR DETERMINATION potentiometer. When testing or calibrating meters, the 0% range should be selected first and the output voltage set to the amplitude at which the meter is to be tested. Since the output amplitude is calibrated on the 0% range, the approximate reading error of the meter can be empirically determined. If the approximate error is less than 0.5% then select the 0.5% ERROR RANGE and if it is greater than 0.5% select the 5% ERROR RANGE. Then the output amplitude can be adjusted over the range selected. The 0% ERROR RANGE will automatically be selected when power is initially applied.

CAUTION

The AC-126 output amplitude will be calibrated to the OUTPUT VOLTAGE switches setting only when the 0% ERROR RANGE is selected.

3-25. ERROR RANGE ADJUSTMENT. A five turn potentiometer and a polarity switch are used to adjust the output amplitude over the range selected on the % ERROR RANGE lighted pushbuttons. When the 0% error range is selected the ERROR DETERMINATION controls are inoperative and the output amplitude will always be calibrated to the output voltage setting.

1. INDICATED ERROR. The INDICATED ERROR switch selects the polarity of the error range adjustment. When minus is selected the ERROR DETERMINATION potentiometer will vary the output amplitude in an increasing direction from the output voltage setting. If plus is selected the ERROR DETERMINATION potentiometer will adjust the output amplitude in a decreasing direction from the output voltage setting. Thus, if on the 0% range (i.e., output voltage calibrated) the meter reads low, by setting the INDICATED ERROR switch to minus the ERROR DETERMINATION potentiometer can be used to increase the AC-126 output amplitude until the meter reads the same as the output voltage setting by selecting one of the error ranges. When reading the error, the setting of the INDICATED ERROR switch is taken into consideration. For example, if the measured error is 0.25% and the INDICATED ERROR switch is set to minus, the error reading is -0.25%.

2. ERROR DETERMINATION. The ERROR DETERMINATION control is a direct reading five turn potentiometer which adjusts the output amplitude over a narrow range as selected on the % ERROR RANGE lighted pushbuttons. When the 0% error range is selected the ERROR DETERMINATION potentiometer is inoperative and the output amplitude will always be calibrated to the output voltage setting. Deviation error is read directly from the potentiometer with a resolution of 0.0002% for the 0.5% range and 0.002% for the 5% error range. The potentiometer makes five complete revolutions and the error percentage is read on the in line readout. For example, on the 5.0% error range the ERROR DETERMINATION control will vary the output amplitude over the range of 0% to ±5.0% from the voltage setting and at 250 the error percentage is read as 2.5%.

3-26. ERROR MEASUREMENT PROCEDURE. The following steps demonstrate a simple technique which can be used to rapidly determine the error of a meter. The procedure is not discussed in detail since each situation must be adapted to the individual instrument or meter being tested. These steps, however, can be used as a general guide to develop testing and calibrating techniques for specific applications.

1. Depress the STANDBY pushbutton to reduce the output voltage to zero and prevent possible damage to the meter being calibrated.

2. Connect the meter to the OUTPUT terminals.

3. If remote sensing is to be used, connect the sense leads between the SENSING terminals and the meter or use the optional four wire output cable (P/N 901383).

4. Set the OUTPUT switch for a floating or grounded output.

5. Set the FREQUENCY and FREQUENCY RANGE controls to the desired output frequency.

6. Set the OUTPUT VOLTAGE switches to the desired output amplitude setting.

7. Depress the VOLTAGE RANGE lighted pushbutton for the amplitude desired.

8. Note the reading on the meter being tested. If the meter reads low set the INDICATED ERROR switch to minus. If it reads high set the INDICATED ERROR switch to plus.

9. Note the approximate percentage of reading error on the meter and depress the 0.5% or 5% ERROR RANGE pushbutton.

10. Adjust the % ERROR potentiometer until the meter reads the same voltage as set on the OUTPUT VOLTAGE switches.

11. Read the error directly on the % ERROR potentiometer, in percent.

3-27. OUTPUT TERMINALS. A set of OUTPUT terminals are provided for the 10mV, 100mV, 1V, 10V and 100V ranges on the Calibrator front panel. When the 1KV EXT range is selected, the output is taken from the cable assembly provided on the 1KV Power Amplifier front panel. Since the AC-126 is capable of operating over a broad range of voltages and frequencies certain precautions must be observed when connecting load cables to the Calibrator. For AC output voltages of between 1 and 100 volts rms and up to 100 kilohertz, the type of leads used is not critical. The leads must be shielded for the lower level outputs (below 1V rms) to minimize noise pickup. For output voltages at frequencies above 100kHz the voltage accuracy and regulation are affected by the type of output cable used. The AC-126 is factory calibrated to meet its specifications in this frequency range with four wire cable assembly (P/N 901383). Use of links and a two wire cable or a four wire cable of different length wire size or insulation type will effect accuracy and regulation and may cause an out of specification condition.

3-28. OPTIONAL OUTPUT CABLE ASSEMBLIES. Two output cables are available from Optimation for the AC-126. The four wire cable

assembly, P/N 901383, is wired for remote sensing and used for general applications on the 1V, 10V or 100V ranges. On the 10mV and 100mV ranges where remote sensing is not used, a two wire, shielded, cable assembly, P/N 901382, is wired to terminate the output terminals for local sensing.

CAUTION

Load leads must always be connected to the OUTPUT terminals and never to the SENSING terminals, even though the shorting straps are in place for local sensing.

3-29. OUTPUT CONNECTIONS. Either a floating or grounded output configuration can be selected on the Calibrator front panel depending on the application and type of load. In general, when the AC-126 is used with an instrument that has a grounded input, such as some digital voltmeters, the output should be set for FLOATING. When driving an instrument or meter that has a floating input, such as a battery operated voltmeter, the output should be set for a grounded output. The configuration is selected by the OUTPUT slide switch. In the floating position the output terminals are isolated from the exterior covers and AC line ground. In the grounded position the LOW SENSING terminal (black) is grounded to the exterior covers and AC line ground. In DC operating mode connect the GUARD input on the instrument being calibrated to the ground terminal on the calibrator.

3-30. REMOTE SENSING. Provisions for sensing on the output amplitude at a remote point (i.e., load) and feeding back an error signal have been made on the AC-126 for the 1V, 10V and 100V ranges. This compensates for the voltage drop in the external load leads. For most applications such as calibrating high input impedance digital voltmeters up to 100kHz the output can be connected for local sensing. However at higher frequencies or if a larger burden is applied or the impedance of the load changes as a function of the input voltage range, as in Thermal Transfer Standard or laboratory type of meter movement, remote sensing must be used to maintain the accuracy of the AC-126 at the load.

NOTE

Conformance to regulation and accuracy specifications above 100kHz on the 1 and 10V ranges are not guaranteed unless the Optimation P/N 901383 cable is used.

The AC-126 is protected against accidental opening or shorting of the remote sensing leads with internal resistors connected between the OUTPUT and SENSING terminals. However, the output voltage and load regulation will not be within specification if the SENSING terminals are not properly terminated for either local or remote sensing.

3-31. Local or remote sensing is determined by the position of the two shorting straps on the OUTPUT and SENSING terminals. To connect the Calibrator for remote sensing the following procedure may be used:

1. Remove the two shorting straps between the OUTPUT and SENSING terminals.

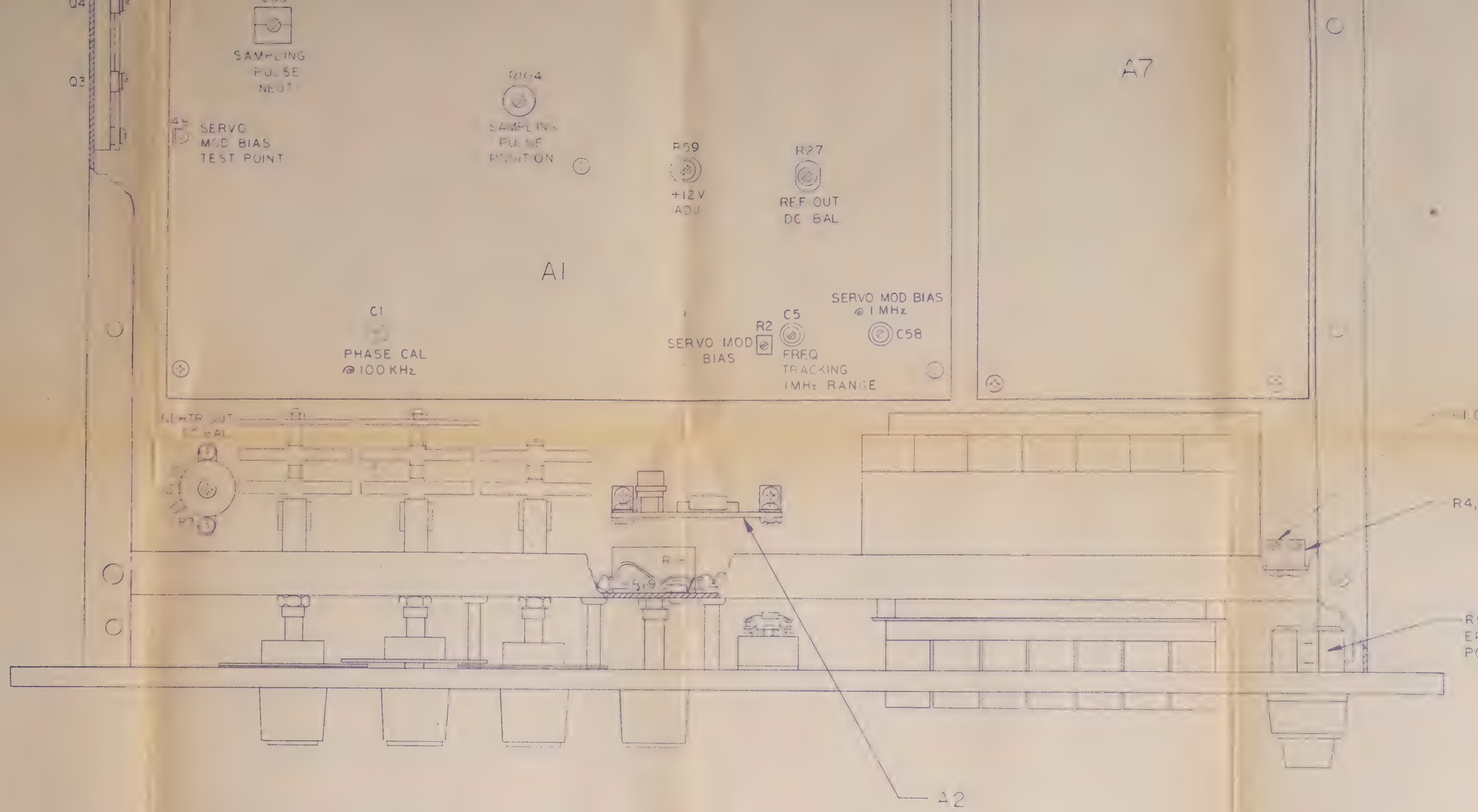
2. Connect the load leads to the OUTPUT terminals.

3. Connect a pair of loosely twisted 22 gauge (or larger) wires between the SENSING terminals and the point where it is desired to maintain the load regulation. Alternately two of the shielded double GR cables using RG58 coax, such as made by Pomona Electric (type 2BC), may be used. The sense cable should plug into the rear of the output cable at the load. The optional four wire output cable assembly (P/N 901383) is recommended for low frequencies and is mandatory above 100kHz if full accuracy is to be obtained. Use caution and observe the polarity when connecting the remote sensing leads.

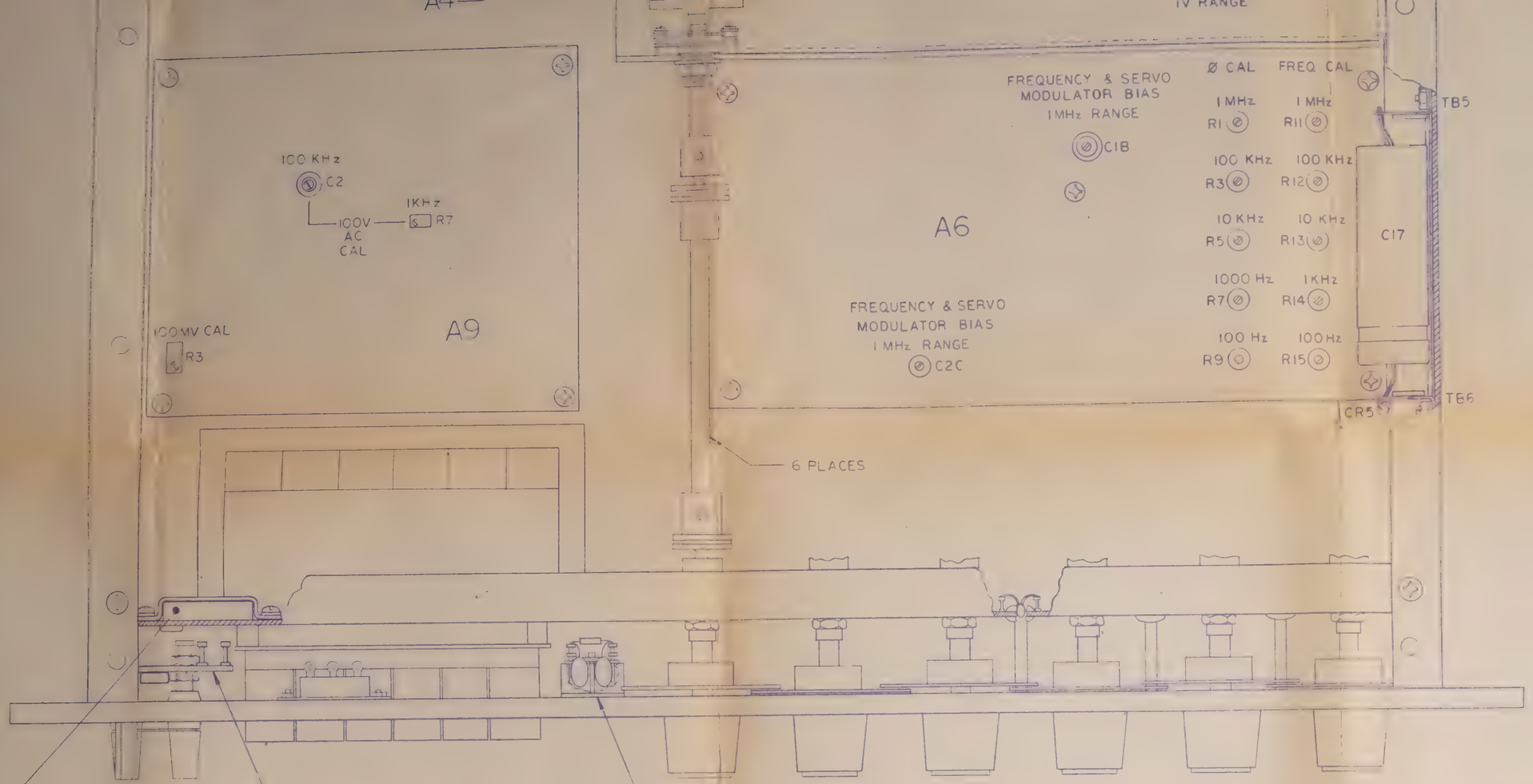
NOTE

When using wires, the load leads and sense leads must be loosely twisted (i.e., one turn every 2 or 3 inches) or excessive capacitive loading will result. For best results, the high and low output leads can be loosely twisted together and the high and low sense leads twisted together. Great care should be exercised to be sure that the wire used is pure copper. Some wire contains copper or tin plated aluminum or steel as in "copper weld". The presence of steel or aluminum may introduce output voltage errors at low voltages in the DC mode due to thermocouple effects.

3-32. OVERLOAD PROTECTION. Overload protection is provided for all operating conditions of the Model AC-126. If the output terminals are accidentally shorted or overloaded on the 1V, 10V or 100V ranges, the instrument will automatically go into the STANDBY mode. Reset of the overload circuits is automatic on the 10 and 100mV ranges.



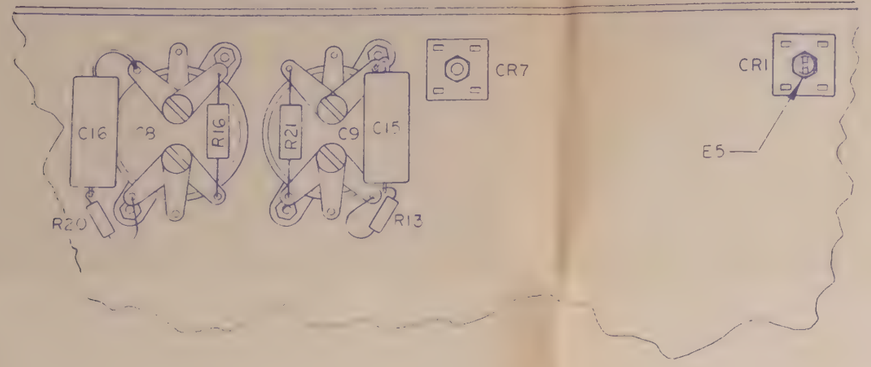
TOP VIEW OF UNIT

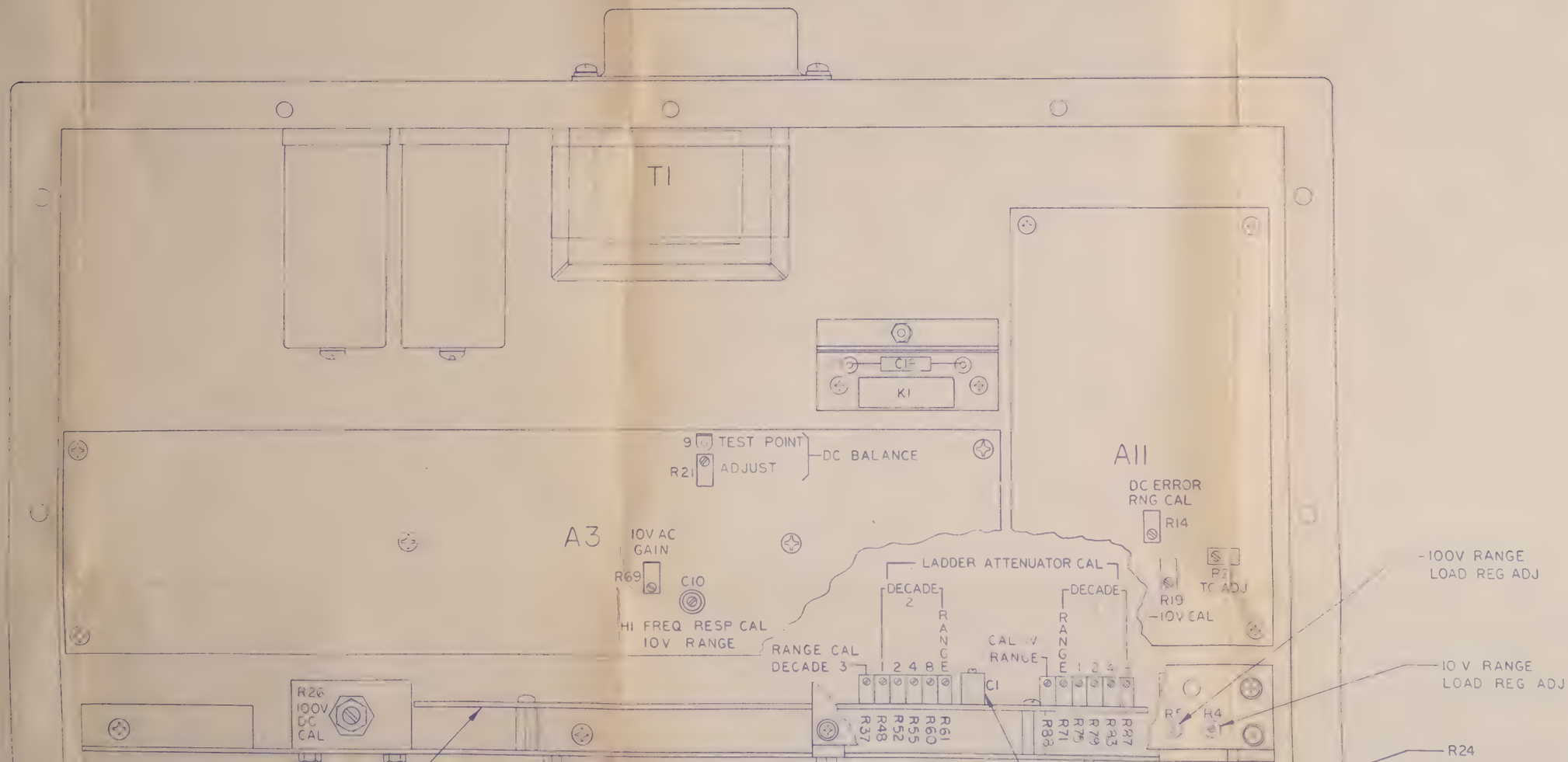


BOTTOM VIEW OF UNIT

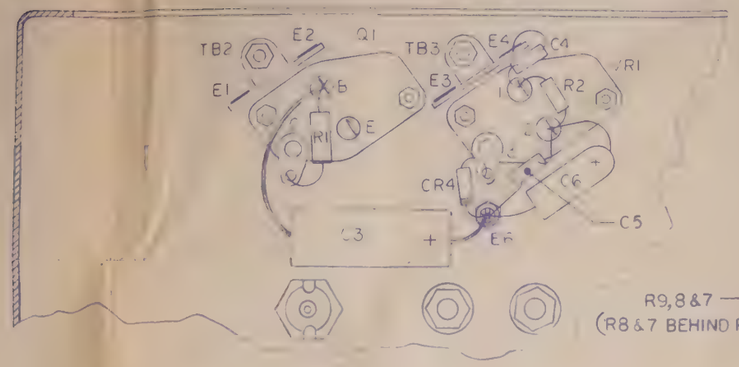
COMPONENTS & ADJUSTMENTS
LOCATION
AC126
PAGE -

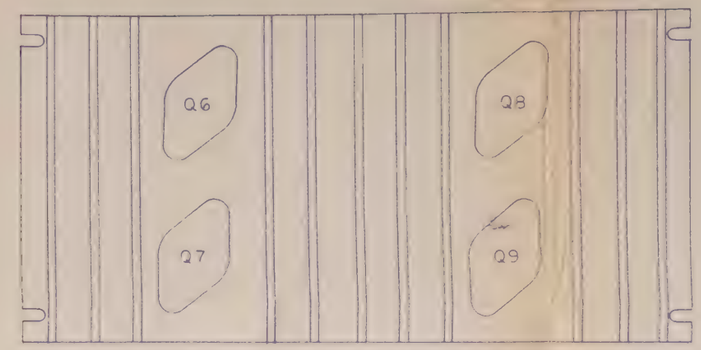
INSIDE VIEW OF WRAP (UPPER PORTION)

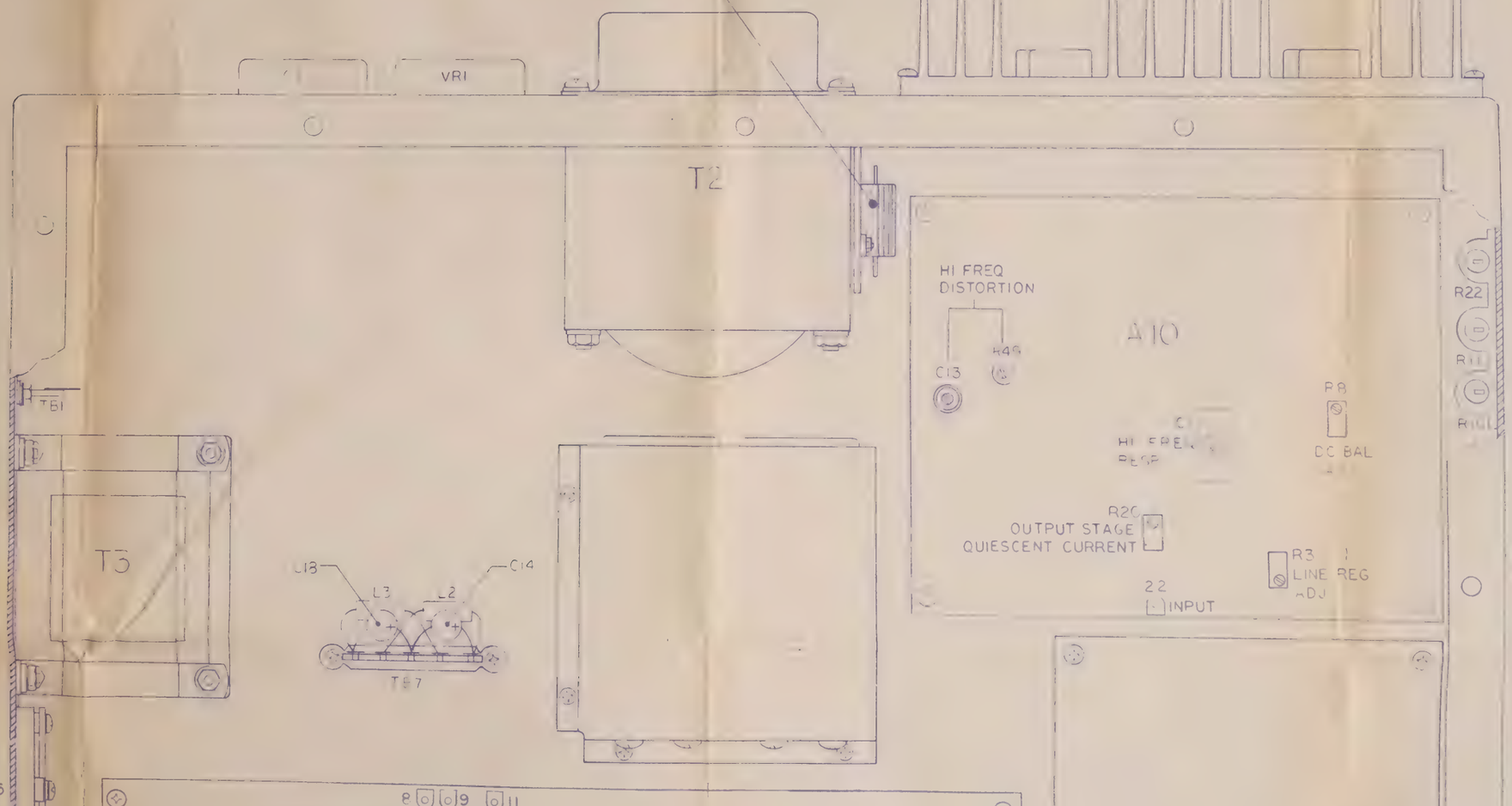




INSIDE VIEW OF WRAP (UPPER PORTION)







SECTION VII

ELECTRICAL PARTS LISTING

7-1. INTRODUCTION.

7-2. This section of the manual contains a complete breakdown and description of the electrical replaceable parts.

7-3. REFERENCE DESIGNATORS.

7-4. GENERAL. The unit numbering method of assigning reference designations has been used to identify subassemblies and parts. An example of this unit system is as follows:

Read as: First resistor (R1) of second subassembly (A2).

7-5. SUBASSEMBLY REFERENCE DESIGNATORS. The following major subassembly reference numbers have been assigned to the Model AC-126.

A1 - Oscillator Circuit Board Assembly.
A2 - Frequency Vernier Buffer Amplifier Circuit Board Assembly.
A3 - 10 Volt Amplifier Circuit Board Assembly.
A4 - Voltage Attenuator Circuit Board Assembly.
A5 - Error Range Calibration Board Assembly.
A6 - Frequency Range Switching Circuit Board Assembly.
A7 - Range Programming Logic Circuit Board Assembly.
A8 - Lo Sense Resistor Circuit Board Assembly.
A9 - Voltage Range Switching Circuit Board Assembly.
A10- 100 Volt Amplifier Circuit Board Assembly.
A11- DC Reference Supply Circuit Board Assembly.

7-6. PARTS ORDERING INFORMATION.

7-7. Replacement parts are available from your local Optimation, Inc. representative or can be obtained from the factory direct. When ordering replacement parts, include the following information:

1. Instrument model number and serial number.

2. Optimation, Inc. part number of replacement part.

3. Reference designator number.

7-8. MANUFACTURERS CODE LISTING. Manufacturers code numbers extracted from the Federal Supply Code Manufacturers Cataloging Handbooks H4-1 are listed in Table 7-2.

7-9. PARTS LISTING. Table 7-1 lists all of the electrical maintenance parts. In addition to the reference designator and part description, the part number for the manufacturer of the part is listed. To find the manufacturer, determine the code number of the part and then refer to the listing in Table 7-2.

SPECIAL NOTES

*Asterisk preceding Optimation Part Number indicates manufactured by or for Optimation, or reworked or checked components.

TABLE 7-1
LIST OF REPLACEABLE PARTS

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
A1	Oscillator Board Assy.	23405	908125	908125
A1AR1	Operational Amplifier: 141C	17850	ZA801M1	547050
A1C1	Cap Var Cer: 2-8pF, NPO 350V	72982	538-011A2-8	532031
A1C2	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C3	Cap Fix Mica: Selected Value			Selected
A1C4	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C5	Cap Var Cer: 2-8pF, 350V, NPO	72982	538-011A2-8	532031
A1C6	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C7	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C8	Cap Fix Cer: 0.1mfd, 100V	72982	CK06BX104K	522200
A1C9	Not Used			
A1C10	Cap Met Poly Carb: 40mfd, 50V	23405	PMF-406K	*523430
A1C11	Not Used			
A1C12	Cap Fix Cer: 0.1mfd, 100V	72982	CK06BX104K	522200
A1C13	Not Used			
A1C14	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C15	Cap Fix Cer: 0.1mfd, 100V	72982	CK06BX104K	522200
A1C16	Cap Fix Elect: 6mfd, 100V	14655	NLW6-100	525020
A1C17	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C18	Not Used			
A1C19	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C20	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C21	Cap Fix Cer: 0.1mfd, 100V	72982	CK06BX104K	522200
A1C22	Cap Fix Cer: 0.01mfd, 100V	72982	805-000-X5V0-103Z	522148
A1C23	Not Used			
A1C24	Cap Fix Cer: 0.1mfd, 100V	72982	CK06BX104K	522200
A1C25	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C26	Cap Fix Tant: 330mfd, 6V	05397	T362D337M006AS	524075
A1C27	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C28	Cap Fix Cer: 0.1mfd, 100V	72982	CK06BX104K	522200
A1C29	Cap Fix Mica: 2400pF, 500V	14655	CD19-FD242J03	520302
A1C30	Cap Fix MPC: 0.68mfd, 100V	18489	PCMF6894K1A	523420
A1C31A	Cap Fix Myl: 0.005mfd, 100V	72136	IDP-1-502	521010
A1C31B	Cap Fix Myl: 0.47mfd, 200V	14655	MMW2P47	521082
A1C31C	Cap Fix Myl: .047mfd, 200V	56289	192P-47392	521029
A1C32	Cap Fix Elect: 6mfd, 100V	14655	NLW6-100	525020
A1C33	Cap Var: 1.8-13pF	94970	189-504-5	531010
A1C34	Cap Fix Cer: 0.001mfd, 1KV	56289	5HK-D10	522140
A1C35	Cap Fix Mica: 39pF, 500V	72136	DM15-390J	520039
A1C36	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C37	Cap Fix Cer: 0.1mfd, 100V	72982	CK06BX104K	522200
A1C38	Cap Fix Cer: 0.01mfd, 100V	72982	805-000-X5V0-103Z	522148
A1C39	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A1C40	Cap Fix Cer: 0.01mfd, 100V	72982	805-000-X5V0-103Z	522148
A1C41	Cap Fix Mica: 500pF, 500V	00853	D155F501K	520200
A1C42	Cap Fix Cer: 0.01mfd, 100V	72982	805-000-X5V0-103Z	522148

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
AIC43	Cap Fix Tant: 47mfd, 15V	05397	T360C476K015AS	524051
AIC44	Cap Fix Tant: 1mfd, 35V	05397	T360A105K035AS	524010
AIC45	Cap Fix Tant: 1mfd, 35V	05397	T360A105K035AS	524010
AIC46	Cap Fix Cer: 0.1mfd, 100V	72982	CK06BX104K	522200
AIC47	Cap Fix Elect: 50mfd, 150V	56289	39D506F150FJ4	525081
AIC48	Cap Fix Elect: 1000mfd, 20V	56289	TL1191	525305
AIC49	Cap Fix Elect: 1000mfd, 20V	56289	TL1191	525305
AIC50	Cap Fix Cer: 0.1mfd, 100V	72982	CK06BX104K	522200
AIC51	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
AIC52	Not Used			
AIC53	Cap Fix Cer: 0.1mfd, 100V	72982	CK06BX104K	522200
AIC54	Not Used			
AIC55	Not Used			
AIC56	Cap Fix Cer: 10pF, 1KV NPO	56289	10TCC-Q10	522030
AIC57	Not Used			
AIC58	Cap Var Cer: 5.5-18pF NPO	72982	538-011A5.5-19	532032
AIC59	Not Used			
AIC60	Not Used			
AIC61	Not Used			
AIC62	Cap Fix Tant: 330mfd, 6V	05397	K330E6	524151
AIC63	Cap Fix Cer: 0.01mfd, 100V	77982	805000X5V0103Z	522148
AIC64	Not Used			
AIC65	Cap Fix Cer: .1mfd, 100V	72982	CK06BX104K	522200
AIC66	Cap Fix Mica: 130pF, 500V	72136	DM15-131J	520077
AIC67	Cap Fix Mica: 75pF, 500V	72136	DM-15-750F	520075
AIC68	Cap Fix Cer: Selected Value			
AIC69	Cap Fix Cer: Selected Value			
AIC70	Cap Fix Mica: 330pF, 500V	72136	DM15-331V	520140
AICR1	Diode: IN3064	07263	IN3064	543200
AICR2	Diode: IN3064	07263	IN3064	543200
AICR3	Diode, Zener: 27V, 5%	04713	IN4750A	544056
AICR4	Diode, Zener: 18V, 10%	04713	IN5248A	544301
AICR5	Diode, Zener: 8.2V, 5%	04713	IN5237B	544031
AICR6	Diode: IN3064	07263	IN3064	543200
AICR7	Diode, Zener: 27V, 5%	04713	IN4750A	544056
AICR8	Diode: IN3064	07263	IN3064	543200
AICR9	Diode, Zener: 18V, 10%	04713	IN5248A	544301
AICR10	Diode: IN3064	07263	IN3064	543200
AICR11	Diode: IN4156	03508	IN4156	543930
AICR12 through AICR15	Diode: IN3064	07263	IN3064	543200
AICR16	Diode, Zener: Reference IN825	23405	IN825	*544016
AICR17	Not Used			
AICR18	Diode, Zener: 5.1V, 5%	04713	IN5321B	544302
AICR19	Diode, Zener: 3.3V, 5%	04713	IN5226B	544005
AICR20	Diode: IN3064	07263	IN3064	543200
AICR21	Diode, Zener: 5.1V, 5%	04713	IN5321B	544302

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR. CODE	MFR. P/N	OPT. P/N
A1CR22 through A1CR31	Diode: IN3064	07263	IN3064	543200
A1CR32	Diode, Curr Reg: 3.3mA	17856	CL3220	544334
A1CR33	Diode, Zener: 5.1V, 5%	04713	IN5231B	544302
A1CR34	Diode: IN3064	07263	IN3064	543200
A1CR35	Diode: IN3064	07263	IN3064	543200
A1DS1	Lamp, Incandescent	00806	#12	551110
A1DS2	Lamp, Incandescent	00806	#12	551110
A1K1	Relay: DPDT 5VDC W/Shield Spl	34667	RR10-1426E	015016
A1L1	Inductor: 10uH, 5%	99800	1537-36	562008
A1L2	Not Used			
A1Q1	Transistor: 2N4221	04713	2N4221	*540198
A1Q2	Transistor: 2N4221	04713	2N4221	*540198
A1Q3	Transistor: PNP 2N5087	04713	2N5087	540275
A1Q4	Transistor: 2N4221	04713	2N4221	*540198
A1Q5	Transistor: 2N4221	04713	2N4221	*540198
A1Q6	Transistor: PNP 2N5087	04713	2N5087	540275
A1Q7	Transistor: PNP 2N5087	04713	2N5087	540275
A1Q8	Transistor: NPN 2N4259	03508	2N4259	540210
A1Q9	Transistor: NPN 2N3707	04713	2N3707	540170
A1Q10	Transistor: NPN 2N4259	03508	2N4259	540210
A1Q11	Transistor: PNP 2N4250	07263	2N4250	540200
A1Q12	Transistor: NPN 2N3707	04713	2N3707	540170
A1Q13	Transistor: PNP 2N4890	04713	2N4890	540250
A1Q14	Transistor: PNP 2N4890	04713	2N4890	540250
A1Q15	Transistor: NPN 2N3512	23405	2N3512	540120
A1Q16	Transistor: NPN 2N3512	23405	2N3512	540120
A1Q17	Transistor: PNP 2N4125	04713	2N5087	540196
A1Q18	Transistor: FET 2N5248	01295	2N5248	540378
A1Q19	Transistor: NPN 2N3707	04713	2N3707	540170
A1Q20	Transistor: NPN 2N3707	04713	2N3707	540170
A1Q21	Transistor: FET 2N4342	07263	2N4342	540225
A1Q22	Transistor: NPN 2N3053-2	23405	2N3053	*540082
A1Q23	Transistor: Dual NPN/PNP TD601	13606	TD601	540317
A1Q24	Transistor: PNP 2N4036-2	02735	2N4036	*540192
A1Q25	Transistor: Dual NPN/PNP TD601	13606	TD601	540317
A1Q26	Transistor: Dual NPN/PNP TD601	13606	TD601	540317
A1Q27	Transistor: PNP 2N4125	04713	2N4125	540196
A1Q28	Transistor: PNP 2N4125	04713	2N4125	540196
A1Q29	Transistor: Dual PNP TD402	13606	TD402	540313
A1Q30	Transistor: PNP 2N4250	07263	2N4250	540200

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
A1Q31	Transistor: Dual PNP TD102	13606	TD102	540308
A1Q32	Transistor: NPN 2N3053-2	23405	2N3053	*540082
A1Q33	Transistor: NPN 2N4383	13606	2N4383	540230
A1Q34	Transistor: PNP 2N4125	04713	2N4125	540196
A1Q35	Transistor: Dual NPN TD100	13606	TD100	540315
A1Q36	Transistor: Dual NPN TD100	13606	TD100	540315
A1Q37	Transistor: FET 2N4392	17856	2N4392	540235
A1Q38	Transistor: NPN 2N4123	04713	2N4123	540199
A1R1	Res Fix MF:			Select
A1R2	Res Var: 500, TRIMMER 22T	73138	78LR500	511092
A1R3	Res Fix MF: 4.42K, 1%, 1/8W	75042	RN55D	502254
A1R4	Res Fix MF: 1.32K, 1%, 1/8W	75042	RN55D	502183
A1R5	Res Fix MF: 5.36K, 1%, ¼W	75042	RN60D	502377
A1R6	Res Fix CC: 100, 10%, 1/8W	01121	BB10110	500054
A1R7	Res Fix MF: 100K, 1%, ¼W	75042	RN60D	502544
A1R8	Not Used			
A1R9	Res Fix MF: 2K, 1%, 1/8W	75042	RN55D	502191
A1R10	Res Fix MF: 16.2K, 1%, ½W	75042	RN65D	502378
A1R11	Res Fix MF: 6.65K, 1%, 1/8W	75042	RN55D	502375
A1R12	Res Fix MF: 2K, 1%, 1/8W	75042	RN55D	502191
A1R13	Not Used			
A1R14	Res Fix MF: 3.01K, 1%, ¼W	75042	RN60D	502198
A1R15	Res Fix CC: 3.9K, 5%, ¼W	01121	CB3925	500155
A1R16	Res Fix CC: 2.2K, 5%, ½W	01121	EB2225	500140
A1R17	Res Silicon: 120, 1/8W	01295	TGX-01	504505
A1R18	Res Fix MF: 3.01K, 1%, ¼W	75042	RN60D	502198
A1R19	Not Used			
A1R20	Res Fix CC: 3.3K, 5%, ½W	01121	EB3325	500150
A1R21	Res Fix MF: 1.5K, 1%, ¼W	75042	RN60D	502179
A1R22	Res Fix CC: 5.1K, 5%, ¼W	01121	CB5125	500173
A1R23	Res Fix MF: 1.5K, 1%, ¼W	75042	RN60D	500179
A1R24	Res Fix MF: 16.2K, 1%, ½W	75042	RN65D	502378
A1R25	Res Fix MF: 332, 1%, ¼W	75042	RN60D	502080
A1R26	Res Fix MF: 1.5K, 1%, ¼W	75042	RN60D	500179
A1R27	Res Var Cer: 1K, 10%, 1T	73138	62PR1K	511162
A1R28	Res Fix CC: 1K, 10%, ½W	01121	EB10210	500120
A1R29	Not Used			
A1R30	Res Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
A1R31	Res Fix MF: 1.5K, 1%, ¼W	75042	RN60D	500179
A1R32	Res Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
A1R33	Res Fix MF: 237, 1%, ¼W	75042	RN60D	502051
A1R34	Res Fix MF: 237, 1%, ¼W	75042	RN60D	502051
A1R35	Res Fix MF: 33.2, 1%, ¼W	75042	RN60D	501985
A1R36	Res Fix MF: 10K, 1%, ¼W	75042	RN60D	502292
A1R37	Res Fix MF: 4.99K, 1%, ¼W	75042	RN60D	502261
A1R38	Res Fix MF; 61.9, 1%, ¼W	75042	RN60D	502000
A1R39	Not Used			
A1R40	Res Fix MF: 2.49, 1%, 1/8W	75042	RN55D	502213

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
AIR41	Res Fix MF: 15K, 1%, ¼W	75042	RN60D	502384
AIR42	Res Fix CC: 10K, 10%, ½W	01121	EB10310	500210
AIR43	Res Fix MF: 432, 1%, ¼W	75042	RN60E	502097
AIR44	Res Fix MF: 6.04K, 1%, ¼W	75042	RN60D	502379
AIR45	Res Fix MF: 6.04K, 1%, ¼W	75042	RN60D	502379
AIR46	Res Fix MF: 3.01K, 1%, ¼W	75042	RN60D	502198
AIR47	Res Fix CC: 2.2K, 5%, ½W	01121	EB2225	500140
AIR48	Res Fix MF: 562, 1%, ¼W	75042	RN60D	502105
AIR49	Res Fix CC: 10M, 10%, ¼W	01121	EB10610	500437
AIR50	Res Fix CC: 10K, 10%, ¼W	01121	EB10310	500216
AIR51	Res Fix CC: 100K, 10%, ½W	01121	EB10410	500280
AIR52	Res Fix CC: 100K, 10%, ½W	01121	EB10410	500280
AIR53	Res Fix CC: 10, 5%, ½W	01121	EB1005	500031
AIR54	Res Fix MF: 49.9K, 1%, ½W	75042	RN65D	502470
AIR55	Res Fix MF: 12.1K, 1%, 1/8W	75042	RN55D	502321
AIR56	Res Fix MF: 5K, 0.1%, 0.3W	18612	V53-3	503017
AIR57	Res Fix MF: 5K, 0.1%, 0.3W	18612	V53-3	503017
AIR58	Res Fix MF: 5K, 0.1%, 0.3W	18612	V53-3	503017
AIR59	Res Var: 200, 20%, 20T	73138	66WR200	511086
AIR60	Res Fix MF: 5.36K, 0.1%, 0.3W	18612	V53-3	503018
AIR61	Res Fix CC: 1M, 5%, ½W	01121	EB1055	500361
AIR62	Res Fix MF: 1.15K, 1%, 1/8W	75042	RN55D	502161
AIR63	Res Fix CC: 15K, 10%, ½W	01121	EB15310	500219
AIR64	Res Fix CC: 470K, 10%, ½W	01121	EB47410	500330
AIR65	Res Fix CC: 1, 5%, ½W	01121	EB0015	500002
AIR66	Res Fix CC: 47K, 10%, ½W	01121	EB47310	500250
AIR67	Res Fix MF: 1M, 1%, ¼W	75042	RN60D	502710
AIR68	Res Fix MF: Selected Value	75042	RN60E	Selected
AIR69	Res Fix CC: 2.2K, 5%, ½W	01121	EB2225	500140
AIR70	Res Fix MF: 604, 1%, 1/8W	75042	RN55D	502110
AIR71	Res Fix CC: 100, 10%, 1/8W	01121	BB10110	500054
AIR72	Res Fix MF: 1.15K, 1%, 1/8W	75042	RN55D	502161
AIR73	Res Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
AIR74	Res Fix MF: Selected Value			
AIR75	Res Fix MF: 6.8K, 1%, ¼W	75042	RN60D	502273
AIR76	Res Fix MF: 2.49K, 1%, 1/8W	75042	RN55D	502213
AIR77	Res Fix CC: 100, 10%, 1/8W	01121	BB10110	500054
AIR78	Res Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
AIR79	REs Fix MF: 2K, 1%, 1/8W	75042	RN55D	502191
AIR80	Res Fix CC: 2.2K, 5%, ½W	01121	EB2225	500140
AIR81	Res Fix MF: 1M, 1%, ¼W	75042	RN60D	502710
AIR82	Res Fix CC: 2.2K, 5%, ½W	01121	EB2225	500140
AIR83	Not Used			
AIR84	Res Fix MF: 332, 1%, ¼W	75042	RN60D	502080
AIR85	Res Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
AIR86	Res Fix CC: 100, 10%, 1/8W	01121	BB10110	500054
AIR87	Res Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
AIR88	Res Fix MF: 665, 1%, 1/8W	75042	RN55D	502107
AIR89	Res Fix MF: 200K, 1%, ½W	75042	RN65D	502580
AIR90	Res Fix MF: 100K, 1%, ¼W	75042	RN60D	502544

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
AIR91	Res Fix MF: 665, 1%, 1/8W	75042	RN55D	502107
AIR92	Res Fix MF: 90.9K, 1%, ½W	75042	RN65D	502530
AIR93	Res Fix CC: 18K, 5%, ½W	01121	EB1835	500230
AIR94	Res Fix CC: 1, 5%, ½W	01121	EB0015	500002
AIR95	Res Fix MF: 20K, 1%, 1/8W	75042	RN55D	502349
AIR96 through AIR99	Res Fix MF: 332, 1%, ¼W	75042	RN60D	502080
AIR100	Res Fix CC: 22K, 5%, ½W	01121	EB2235	500235
AIR101	Res Fix CC: 22K, 5%, ½W	01121	EB2235	500235
AIR102	Res Fix CC: 1.5K, 5%, 2W	01121	HB1525	500135
AIR103	Not Used			
AIR104	Res Var WW: 10K, ½W, 1T	02111	84-3-8-103	511220
AIR105 through AIR108	Res Fix CC: 20K, 5%, ½W	01121	EB2035	500233
AIR109	Res Fix MF: 34.8K, 1%, 1/8W	75042	RN55D	502420
AIR110	Res Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
AIR111	Res Fix MF: 2K, 1%, 1/8W	75042	RN55D	502191
AIR112	REs Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
AIR113	Res Fix MF: 2.1K, 1%, ¼W	75042	RN60D	502172
AIR114	Res Fix MF: 4.22K, 1%, 1/8W	75042	RN55D	502249
AIR115	Not Used			
AIR116	Res Fix MF: 953, 1%, 1/8W	75042	RN55D	502142
AIR117	Res Fix MF: 953, 1%, 1/8W	75042	RN55D	502142
AIR118	Res Fix CC: 2.2K, 5%, ½W	01121	EB2225	500140
AIR119	Res Fix CC: 51, 10%, ¼W	01121	CB51010	500052
AIR120	Res Fix CC: 18, 5%, ¼W	01121	CB1805	500039
AIR121	Not Used			
AIR122	Not Used			
AIR123	Not Used			
AIR124	Res Fix CC: 100, 10%, 1/8W	01121	BB10110	500054
AIR125	Not Used			
AIR126	Res Fix CC: 100, 10%, ¼W	01121	CB10110	500069
AIR127	Res Fix CC: 100, 10%, 1/8W	01121	BB10110	500054
AIR128	Not Used			
AIR129	REs Fix CC: 2.2K, 5%, ½W	01121	EB2225	500140
AIR130	Res Fix CC: 1K, 10%, ¼W	01121	CB10210	500110
AIR131	Res Fix CC: 1K, 10%, ¼W	01121	CB10210	500110
AIR132	Res Fix CC: 51, 10%, ¼W	01121	CB51010	500052
AIR133	Not Used			
AIR134	Res Fix CC: 18, 5%, ¼W	01121	CB1805	500039
AIR135	REs Fix CC: 10K, 5%, ¼W	01121	CB1035	500200
AIR136	REs Fix CC: 1K, 10%, ¼W	01121	CB10210	500110
AIR137	Res Fix CC: 100, 10%, 1/8W	01121	BB10110	500054
AIR138	Not Used			
AIR139	Res Fix CC: 3.3K, 5%, ½W	01121	EB3325	500150
AIR140	Res Fix CC: 470, 5%, ¼W	01121	CB4715	500085
AIR141	Not Used			
AIR142	Res Fix CC: Select In Test			

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
A1R143	Res Fix CC: 1.5K, 5%, ½W	01121	EB1525	500132
A1R144	Not Used			
A1R145	Res Fix CC: 100, 10%, ¼W	01121	CB10110	500069
A1U1	Dual Comparator	07263	uA711	547102

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR. CODE	MFR. P/N	OPT. P/N
A2	Frequency Vernier Buffer Amplifier	23405	902115	902115
A2C1	Cap Fix Tant: 22mfd, 15V	56289	CS13BD226K	524040
A2C2	Cap Fix Cer: 0.1mfd, 100V	72982	CK06BX104K	522200
A2C3	Cap Fix Tant: 10mfd, 35V	05397	T360C106M035AS	524022
A2C4	Cap Fix Tant: 100mfd, 20V	05397	T360D107M020AS	524075
A2C5	Cap Fix Cer: 47pF, 1KV, NPO	56289	10TCC-V47	522065
A2C6	Cap Fix MICA: 390pF, 100V	14655	CD15FD391J03	520150
A2R1	Res Fix CC: 470, 5%, ¼W	01121	CB4715	500085
A2R2	Res Fix CC: 10K, 5%, ¼W	01121	CB1035	500200
A2R3	Res Fix CC: 51, 5%, ¼W	01121	CB5105	500052
A2R4	Res Fix MF: 75, 1%, ¼W	75042	RN60D75R0F	502042
A2R5	Res Fix CC: 100, 5%, ¼W	01121	CB1015	500069
A2R6	Res Fix MF: 499, 1%, ¼W	75042	RN60D4990F	502032
A2R7	Res Fix MF: 1.5K, 1%, ¼W	75042	RN60D1501F	502179
A2R8	Res Fix CC: 10, 10%, ¼W	01121	CB10010	500030
A2Q1	Transistor: Dual NPN/PNP, TD601	13606	TD601	540317
A2Q2	Transistor: NPN, 2N3512	23405	2N3512	540120

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
A3	10V Amplifier	23405	908023	908023
A3AR1	Chopper-Stabilized Opnl Ampl	23405	547034	547034
A3C1	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A3C2	Cap Fix Tant: 1mfd, 35V	05397	T362A105K035AS	524012
A3C3	Not Used			
A3C4	Cap Var: 1-14pF	18736	TF14A	530021
A3C5	Cap Fix PC: .01mfd, 10%, 100V	18489	PCT103K1A	521183
A3C6	Cap Fix Met Poly: .022mfd, 100V	18489	PCMF223K1A	521188
A3C7	Not Used			
A3C8	Cap Fix Cer: .001 mfd, 1KV, Z5U	56289	5HK-D10	522140
A3C9	Cap Fix Cer: .1mfd, 10%, 100V	72982	CK06BX104K	522200
A3C10	Cap Fix Cer: .1mfd, 10%, 100V	72982	CK06BX104K	522200
A3C11	Cap Fix Tant: 1mfd, 35V	05397	T362A105K035AS	524012
A3C12	Cap Fix Tant: 10mfd, 35V	05397	T362A106K035AS	524022
A3C13	Cap Fix Tant: 10mfd, 35V	05397	T362A106K035AS	524022
A3C14	Cap Fix Cer: .1mfd, 10%, 100V	72982	CK06BX104K	522200
A3C15	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A3C16	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A3C17	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A3C18	Cap Fix Cer: .1mfd, 10%, 100V	72989	CK06BX104K	522200
A3C19	Cap Fix Mica: 180pF, 500V	72136	DM15-181J	520090
A3C20	Cap Fix MPC: .68mfd, 100V	18489	PCMF684K1A	523420
A3C21	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A3C22	Cap Fix Cer: .01mfd, 100V	72982	805-000Z5V0103Z	522148
A3C23	Cap Fix Elect: 20mfd, 150V	56289	TE1509	525056
A3C24	Cap Fix Cer: .001mfd, 1KV, Z5U	56289	5HK-D10	522140
A3C25	Cap Fix Elect: 1000mfd, 50V		EG1000/50	525260
A3C26	Cap Fix Cer: .001mfd, 1KV, Z52	56289	5HK-D10	522140
A3C27	Cap Fix Elect: 1000mfd, 50V		EG1000/50	525260
A3C28	Cap Fix Cer: 390pF, 100V, NPO	72982	ET06-000C0G0391K	522072
A3C29	Cap Fix Cer: .22pF, 1KV, NPO	56289	10TCC-Q22	522050
A3C30	Cap Fix Mica: 330pF, 100V	14655	CD15FD331V03	520140
A3C31	Cap Fix Cer: 47pF, 5%, 1KV, NPO	56289	10TCC-Q47	522065
A3C32	Cap Fix Cer: 1.5pF, 1KV, NPO	56289	10TCC-V15	522010
A3C33	Cap Fix MMWF: .15mfd, 3%, 50V	18489	EFX153D.5R	521050
A3CR1	Diode	07263	1N3064	543200
A3CR2	Not Used			
A3CR3	Not Used			
A3CR4	Diode	07397	1N4449	543940
A3CR5	Diode	07263	1N3064	543200
A3CR6	Part of Output Xstr Set	23405	1N4449	902689
A3CR7	Part of Output Xstr Set	23405	1N4449	902689
A3CR8	Diode	07263	1N3064	543200
A3CR9	Diode Rect. 400V, 1A	04713	1N4005	543928

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
A3CR10	Diode	07263	1N3064	543200
A3CR11	Diode	07263	1N3064	543200
A3CR12 through A3CR14	Diode Rect. 400V, 1A	04713	1N4005	543928
A3CR15	Diode Bridge 100V, 1A	30857	VE18	545042
A3CR16	Diode Rect. 400V, 1A	04713	1N4005	543928
A3CR17	Diode Rect. 400V, 1A	04713	1N4005	543928
A3DS1	Lamp, 14V, .24A	24455	1891	551145
A3DS2	Lamp, 14V, .24A	24455	1891	551145
A3K1	Relay: Form 1C (SPDT), 12V	15636	RA30201121	015067
A3Q1	Xstr NPN	07263	2N2219	540913
A3Q2	Xstr Dual FET	17866	2N5566	540296
A3Q3	Xstr Dual NPN	13606	TD100	540315
A3Q4	Xstr PNP	04713	2N5087	540275
A3Q5	Xstr NPN	01295	2N929A	540023
A3Q6	Xstr NPN	01295	2N929A	540023
A3Q7	Xstr NPN	01295	2N3707	540170
A3Q8	Xstr NPN	03508	2N5249	540280
A3Q9	Xstr NPN	03508	2N5249	540280
A3Q10	Xstr PNP	23405	2N4036-2	540192
A3Q11 through A3Q14	Output Xstr Set	23405	902689	902689
A3R1	Res Fix CC: 100, 5%, ¼W	01121	RC07	500069
A3R2	Res Fix CC: 1K, 5%, ¼W	01121	RC07	500110
A3R3	Res Fix CC: 3K, 5%, ¼W	01121	RC20	500153
A3R4	Res Fix MF: 12.1K, 1%, 1/8W	75042	RN55D	502321
A3R5	Res Fix MF: 17.225K, .01%, .3W	18612	S102M	503077
A3R6	Not Used			
A3R7	Res Fix MF: 49.9K, 1%, ¼W	75042	RN60D	502471
A3R8	Res Fix CC: 5.1K, 5%, ¼W	01121	RC07	500173
A3R9	Res Fix MF: 40.2K, 1%, 1/8W	75042	RN55D	502442
A3R10	Res Fix MF: 3.445K, .01%, .3W	18612	S102M	503072
A3R11*	Res Fix WW: 20K, .02%, ½W	07088	3167-PS	507403
A3R12	Res Fix CC: 10, 5%, ¼W	01121	RC07	500030
A3R13*	Res Fix WW: 100K, .02%, 3/4W	07088	3167-PS	507403
A3R14*	Res Fix WW: 999.5K, .02%, 3/4W	07088	3167-PS	507403
A3R15	Res Fix CC: 27K, 5%, ¼W	01121	RC07	500239
A3R16	Res Fix CC: 51K, 5%, ¼W	01121	RC07	500255
A3R17	Res Fix CC: 2.4K, 5%, ½W	01121	RC20	500144
A3R18	Not Used			

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR. CODE	MFR P/N	OPT. P/N
A3R19	Res Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
A3R20	Res Fix MF: 60.4K, 1%, 1/8W	75042	RN55D	502503
A3R21	Res Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
A3R22	Res Fix MF: 60.4K, 1%, 1/8W	75042	RN55D	502503
A3R23	Res Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
A3R24	Res Fix CC: 1.5K, 5%, ½W	01121	RC20	500132
A3R25	Res Fix MF: 2.43K, 1%, ¼W	75042	RN60D	502209
A3R26	Res Fix CC: 100, 5%, ¼W	01121	RC07	500069
A3R27 through A3R34	Not Used			
A3R35	Res Fix CC: 100, 5%, ¼W	01121	RC07	500069
A3R36	Res Fix MF: 3.01K, 1%, ¼W	75042	RN60D	502198
A3R37	Res Fix MF: 3.01K, 1%, ¼W	75042	RN60D	502198
A3R38	Res Fix MF: 1.21K, 1%, ¼W	75042	RN60D	502176
A3R39	Res Fix CC: 2.2M, 5%, ½W	01121	RC20	500390
A3R40	Res Var Cer: 100K, 10%, 20T	73138	66WR100K	511302
A3R41	Res Fix WW: 10K, 5%, 5W	44655	995-5B	507280
A3R42	Res Fix MF: 6.04K, 1%, ¼W	75042	RN60D	502379
A3R43	Res Fix MF: 665, 1%, ¼W	75042	RN60D	502111
A3R44	Res Fix CC: 5.1K, 5%, ¼W	01121	RC07	500173
A3R45	Res Fix CC: 1K, 5%, ¼W	01121	RC07	500110
A3R46	Res Fix MF: 280, 1%, 1W	75042	RN70D	502072
A3R47	Res Fix CC: 47, 5%, ¼W	01121	RC07	500060
A3R48	Res Fix WW: 15K, 5%, 5W	44655	200-5-¼	507085
A3R49	Res Fix CC: 47, 5%, ¼W	01121	RC07	500060
A3R50	Res Fix CC: 3.3, 5%, ½W	01121	RC20	500007
A3R51	RES Fix CC: 100, 5%, ¼W	01121	RC07	500069
A3R52	Res Fix CC: 47, 5%, ¼W	01121	RC07	500060
A3R53	Res Fix CC: 3.3, 5%, ½W	01121	RC20	500007
A3R54	Res Fix CC: 100, 5%, ¼W	01121	RC07	500069
A3R55	Res Fix CC: 47, 5%, ¼W	01121	RC07	500060
A3R56	Res Fix CC: 3.3, 5%, ½W	01121	RC20	500007
A3R57	Res Fix MF: 1.3K, 1%, ¼W	75042	RN60D	502177
A3R58	Res Fix CC: 47, 5%, ¼W	01121	RC07	500060
A3R59	Res Fix CC: 3.3, 5%, ½W	01121	RC20	500007
A3R60	Res Fix CC: 10, 5%, ¼W	01121	RC07	500030
A3R61	Res Fix CC: 10, 5%, ¼W	01121	RC07	500030
A3R62	Res Fix CC: 22K, 5%, ½W	01121	RC20	500235
A3R63	Not Used			
A3R64	Res Fix CC: 1, 5%, ½W	01121	RC20	500002
A3R65	Res Fix CC: 1, 5%, ½W	01121	RC20	500002
A3R66	Res Fix CC: 1.5K, 5%, ½W	01121	RC20	500132
A3R67	Res Fix CC: 1.5K, 5%, ½W	01121	RC20	500132
A3R68	Res Fix MF: 100, 1%, 1/8W	91637	MF-1/10	505010
A3R69	Res Var Cer: 10, 10%, 20T	73138	66WR10	511049
A3R70	Res Fix MF: 18.2K, 1%, 1/8W	75042	RN55D	502341
A3U1	Photo Isolator	03911	CLI-3	547300

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
A3U2	Dual Comparator	18324	N5711A	547040
A3VR1	Zener Diode: 6.2V, 400MW	04713	1N821	544017
A3VR2	Not Used			
A3VR3	Zener Diode: 6.2V, 400MW	04713	1N821	544017
A3VR4	Zener Diode: 6.2V, 400MW	04713	1N821	544017
A3VR5	Zener Diode: 35V, 5%, 1W	04713	1N4713	544058
A3VR6	Zener Diode: 27V, 5%, 1W	04713	1N4750A	544056
A3VR7	Zener Diode: 27V, 5%, 1W	04713	1N4750A	544056
A3VR8	Zener Diode: 30V, 5%, 1W	04713	1N4751A	544099
A3VR9	Zener Diode, 6.2V, 400MW	04713	1N821	544017

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR. CODE	MFR. P/N	OPT. P/N
A4	Voltage Attenuator Board Assy.	23405	908025	908025
A4C1	Cap Var Piston: 1-14pF	18736	TF14A	530021
A4C2	Cap Fix Cer: 12pF, 5%, 1KV, NPO	56289	10TCC-Q12	522035
A4K1	Relay: SPDT, 12V	77342	R10-53-397-1	015075
A4R1	Res Fix CC: 9.1K, 5%, ¼W	01121	RC07	500191
A4R2 through A4R4	Res Fix MF: 1K, 1%, 1/8W	75092	RN55D	502130
A4R5 through A4R9	Res Fix MF: 2K, 1%, 1/8W	75042	RN55D	502191
A4R10	Res Fix CC: 8.2K, 5%, ¼W	01121	RC07	500186
A4R11 through A4R13	Res Fix MF: 1K, 1%, 1/8W	75042	RN55D	502130
A4R14 through A4R18	Res Fix MF: 2K, 1%, 1/8W	75042	RN55D	502191
A4R19	Res Fix MF: 8.06K, 1%, ¼W	76042	RN60D	502272
A4R20 through A4R22	Res Fix MF: 1K, .01%, .3W	18612	S102	502136
A4R23 through A4R27	Res Fix MF: 2K, .01%, .3W	18612	S102	502193
A4R28	Res Fix MF: 8.1K, .1%, 1/8W	75042	CEA T-2	502277
A4R29 through A4R31	Res Fix MF: 1K, .01%, .3W	18612	S102	502136
A4R32 through A4R36	Res Fix MF: 2K, .01%, .3W	186112	S102	502193
A4R37	Res Var Cerm: 200, 10%	73138	76PR200	511087
A4R38	Res Fix MF: 100, 1%, 1/8W	75042	RN55D	502025
A4R39	Res Fix MF: 43.2, 1%, 1/8W	91637	MF-1/10	505004
A4R40	Res Fix MF: 8.066K, .01%, .3W	18612	S102	502286
A4R41	Res Fix MF: 1K, .01%, .3W	18612	S102	502136
A4R42	Res Fix MF: 1K, .01%, .3W	19612	S102	502136
A4R43	Res Fix MF: 1K, .005%, .3W	18612	S102M	503069
A4R44	Res Fix MF: 2K, .01%, .3W	18612	S102	502193
A4R45	Res Fix MF: 199.5, .01%, .3W	18612	S102	502188
A4R46	Res Fix MF: 10, 1%, 1/8W	75042	RN55D	502006
A4R47	Res Fix MF: 40.2, 1%, 1/8W	75042	RN55D	502013
A4R48	Res Var Cer: 50, 20%	73138	76PR50	511056

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
A4R49	Res Fix MF: 1991.5, .01%, .3W	18612	S102	502188
A4R50	Res Fix MF: 10, 1%, 1/8W	75042	RN55D	502006
A4R51	Res Fix MF: 40.2, 1%, 1/8W	75042	RN55D	502013
A4R52	Res Var Cer: 50, 20%	73138	76PR50	511056
A4R53	Res Fix MF: 1991.5, .01%, .3W	18612	S102	502188
A4R54	Res Fix MF: 10, 1%, 1/8W	75042	RN55D	502006
A4R55	Res Fix MF: 40.2, 1%, 1/8W	75042	RN55D	502013
A4R56	Res Var Cer: 50, 20%	73138	76PR50	511056
A4R57	Res Fix MF: 1991.5, .01%, .3W	18612	S102M	503071
A4R58	Res Fix MF: 10, 1%, 1/8W	91637	MF-1/10	505006
A4R59	Res Fix MF: 40.2, 1%, 1/8W	91637	MF-1/10	505009
A4R60	Res Var Cer: 50, 20%	73138	76PR50	511056
A4R61	Res Var Cer: 200, 10%	73138	76PR200	511087
A4R62	Res Fix MF: 100, 1%, 1/8W	91631	MF-1/10	505010
A4R63	Res Fix MF: 100, 1%, 1/8W	91631	MF-1/10	505004
A4R64	Res Fix MF: 43.2, 1%, 1/8W	18612	S102M	503076
A4R65	Res Fix MF: 8.066K, .01%, .3W	18612	S102M	503069
A4R66	Res Fix MF: 1K, .005%, .3W	18612	S102M	503069
A4R67	Res Fix MF: 1K, .005%, .3W	18612	S102M	503069
A4R68	Res Fix MF: 1991.5, .01%, .3W	18612	S102M	503071
A4R69	Res Fix MF: 10, 1%, 1/8W	91637	MF-1/10	505006
A4R70	Res Fix MF: 40.2, 1%, 1/8W	91637	MF-1/10	505009
ArR71	Res Var Cer: 50, 20%	73133	76PR50	511056
A4R72	Res Fix MF: 1991.5, .01%, .3W	18612	S102M	503071
A4R73	Res Fix MF: 10, 1%, 1/8W	91637	MF-1/10	505006
A4R74	Res Fix MF; 40.2, 1%, 1/8W	91637	MF-1/10	505009
A4R75	Res Var Cer: 50, 20%	73138	76PR50	511056
A4R76	Res Fix MF: 1991.5, .01%, .3W	18612	S102M	503071
A4R77	Res Fix MF: 10, 1%, 1/8W	91637	MF-1/10	505006
A4R78	Res Fix MF: 40.2, 1%, 1/8W	91637	MF-1/10	505009
A4R79	Res Var Cer: 50, 20%	73138	76PR50	511056
A4R80	Res Var MF: 1991.5, .01%, .3W	18612	S102M	503071
A4R81	Res Fix MF: 10, 1%, 1/8W	91637	MF-1/10	505006
A4R82	Res Fix MF: 40.2, 1%, 1/8W	91637	MF-1/10	505009
A4R83	Res Var Cer: 50, 20%	73138	76PR50	511056
A4R84	Res Fix MF: 1991.5, .01%, .3W	18612	S102M	503071
A4R85	Res Fix MF: 10, 1%, 1/8W	91637	MF-1/10	505006
A4R86	Res Fix MF: 40.2, 1%, 1/8W	91637	MF-1/10	505009
A4R87	Res Var Cer: 50, 20%	73138	76PR50	511056
A4R88	Res Var Cer: 200, 10%	73138	76PR200	511087
A4R89	Res Fix MF: 43.2, 1%, 1/8W	91637	MF-1/10	505004
A4R90	Res Fix MF: 100, 1%, 1/8W	91637	MF-1/10	505010
A4R91	Res Fix MF: 8.066K, .01%, .3W	18612	S102M	503076
A4R92	Res Fix MF: 900, .01%, .3W	18612	S102M	503068

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR. CODE	MFR. P/N	OPT. P/N
A5	Error Range Calibration Board	23405	903028	903028
A5R1	REs Fix MF: 105K, 1%, ¼W T.O.	75042	RN60D	502543
A5R2	Res Var Cer: 20K, 10%, 15T	73138	76PR20K	511243
A5R3	Res Var Cer: 1K, 10%, 15T	73138	76PR1K	511157
A5R4	Res Fix MF: 6.49K, 1%, ¼W, T.O.	75042	RN60D	502307
A6	Frequency Range Programming Board Assy.	23405	908007	908007
A6C1A	Cap Fix Mica: 220pF, 500V	72136	DM15-221F	520110
A6C1B	Cap Var: 1-14pF	16509	.TF14A	530021
A6C2A	Cap Fix Mica: 910pF, 500V	72136	DM19-911F	520230
A6C2B	Cap Fix Mica: 75pF, 500V	72136	DM15-750F	520075
A6C2C	Cap Var: 5.5-18pF	72982	538-011A-5.5-18	532032
A6C3	Cap Fix Mica: 0.0025mfd, 500V	72136	DM19-252F Graded	*520301
A6C4	Cap Fix Mica: 0.01mfd, 500V	72136	DM20-103F Graded	*520501
A6C5	Cap Fix Poly Sty: 0.025mfd, 50V	23405	RT253 G.5A Graded	*523041
A6C6	Cap Fix Poly Sty: 0.1mfd, 50V	23405	RT104 G.5A Graded	*523046
A6C7	Cap Fix Poly Sty: 0.25mfd, 50V	23405	RT254 G.5A Graded	*523063
A6C8	Cap Fix Poly Sty: 1mfd, 50V	23405	RT105 G.5A Graded	*523101
A6C9	Cap Fix Poly Carb: 10mfd, 30V	23405	PMT995J.3A Graded	*521178
A6C10	Cap Fix Poly Carb: 2.5mfd, 50V	23405	PCMF23753J.5A Graded	*523141
A6CR1 through A6CR4	Diode: IN3064	07263	IN3064	543200
A6CR5	Diode: IN4004	04713	IN4004	543927
A6CR6	Diode: IN4004	04713	IN4004	543927
A6CR7 through A6CR18	Diode: IN3064	07263	IN3064	543200
A6K1	Relay: DPST 12VDC	09250	R2695-2	015038
A6K2	Relay: SPST 12VDC	09250	R2694-2	015033
A6K3	Relay: DPST 12 VDC	09250	R2695-2	015038
A6K4	Relay: SPST 12 VDC	09250	R2694-2	015033
A6K5 through A6K15	Relay: DPST 12 VDC	09250	R2695-2	015038
A6R1	Res Var: 500, 10%, ½W	73138	62PR500	511089
A6R2	Not Used			

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR. P/N	OPT. P/N
A6R3	Res Var: 500, 10%, ½W	73138	62PR500	511089
A6R4	Not Used			
A6R5	Res Var: 500, 10%, ½W	73138	62PR500	511089
A6R6	Not Used			
A6R7	Res Var: 500, 10%, ½W	73138	62PR500	511089
A6R8	Not Used			
A6R9	Res Var: 500, 10%, ½W	73138	62PR500	511089
A6R10	Not Used			
A6R11 through A6R15	Res Var: 50, 10%, ½W	73138	62PR50	511057
A6R16	Res Thermister: 3K, 1%	97794	44005-29F203	506040
A6R17	Res Fix MF: 1K, 1%, ½W	75042	RN65D	502131
A6R18	Res Fix MF: 499, 1%, ¼W	75042	RN60D	502109
A6R19	Res Fix MF: 1.5K, 1%, ½W	75042	RN65D	502180
A6R20	Res Fix WW: 800, 2%, 2W	01686	R-75	507233
A6R21	Res Fix MF: 499, 1%, ¼W	75042	RN60D	502109

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
A7	Range Programming Logic	23405	908025	908025
A7C1	Cap Fix Tant: 100mfd, 20%, 20V	05397	T362D107M020AS	524075
A7C2	Cap Fix Tant: 10mfd, 20%, 35V	05397	T362D106M035AS	524022
A7C3	Cap Fix Tant: 10mfd, 20%, 35V	05397	T362D106M035AS	524022
A7C4	Cap Fix Cer: .1mfd, 100V	72982	CK06BX104K	522200
A7C5	Cap Fix Cer: .1mfd, 100V	72982	CK06BX104K	522200
A7C6 through A7C8	Cap Fix Tant: 10mfd, 20%, 35V	05397	T362D106M035AS	524022
A7C9	Not Used			
A7C10	Cap Fix Cer: .01mfd, 100V, Z5V	72982	805-000Z5V0103Z	522148
A7C11 through A7C17	Not Used			
A7C18	Cap Fix Tant: 1mfd, 20%, 35V	05357	T362D105M035AS	524012
A7C19	Cap Fix Cer: .001mfd, 1KV, Z5U	56289	5HK-D10	522140
A7C20	Cap Fix Tant: 10mfd, 20%, 35V	05397	T362D106M035AS	524022
A7C21	Not Used			
A7C22	Not Used			
A7C23	Cap Fix Tant: 2.2mfd, 10%, 35V	05397	T362B225K035AS	524013
A7C24	Not Used			
A7C25	Cap Fix Cer: .01mfd, 100V, Z5V	05397	805-000Z5V0103Z	522148
A7C26 through A7C31	Not Used			
A7C32	Cap Fix Tant: 10mfd, 20%, 35V	05397	T362D106M035AS	524022
A7C33	Cap Fix Tant: 1mfd, 20%, 35V	05397	T362D105M035AS	524012
A7C34	Cap Fix Tant: .47mfd, 20%, 35V	05397	T362B474M035AS	524008
A7C35	Cap Fix Tant: .47mfd, 20%, 35V	05397	T362B474M035AS	524008
A7CR1 through A7CR68	Diode, SML Sig, Silicon	07263	IN3064	543200
A7CR69	Not Used			
A7CR70 through A7CR72	Diode, SML, Sig, Silicon	07263	IN3064	543200
A7CR73	Not Used			
A7CR74 through A7CR78	Diode, SML Sig, Silicon	07263	IN3064	543200
A7K1	Relay, Dip, SPST, 12V	78290	MRRQ1AV	015014
A7K2	Relay, Dip, SPST, 12V	78290	MRRQ1AV	015014
A7L1	Inductor, Fix: 100uh	99800	1537-76	562040

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
A7Q1 through A7Q17	Xstr, PNP Darlington	04713	MJE700	540295
A7R1	Res Fix CC: 3.3K, .5%, ¼W	01121	RC07	500149
A7R2	Res Fix CC: 3.3K, .5%, ¼W	01121	RC07	500149
A7R3	Res Fix MF: 6.04K, 1/8W	75042	RN55D	502269
A7R4 through A7R7	Res Fix CC: 3.3K, 5%, ¼W	01121	RC07	500149
A7R8 through A7R14	Not used			
A7R15	Res Fix MF: 30.1K, 1/8W	75042	RN55D	502398
A7R16	Res Fix CC: 100, 10%, ¼W	01121	RC07	500069
A7R17	Res Fix CC: 4.7K, 5%, ¼W	01121	RC07	500169
A7R18	Not Used			
A7R19	Res Fix CC: 10K, 5%, ¼W	01121	RC07	500200
A7R20	Res Fix CC: 3.3K, 5%, ¼W	01121	RC07	500149
A7R21	Not Used			
A7R22 through A7R27	Res Fix CC: 3.3K, 5%, ¼W	01121	RC07	500149
A7R28 through A7R33	Not Used			
A7R34 through A7R36	Res Fix CC: 3.3K, 5%, ¼W	01121	RC07	500149
A7R37 through A7R39	Res Fix CC: 4.7K, 5%, ¼W	01121	RC07	500169
A7R40	Res Fix CC: 22K, 5%, 1/8W	01121	RC05	500232
A7R41	Res Fix CC: 100K, 5%, 1/8W	01121	RC05	500278
A7R42	Res Fix CC: 100K, 5%, 1/8W	01121	RC05	500278
A7U1 through A7U3	IC, 4 x 2 Input Nand Gate	04713	MC846P	547152
A7U4	IC, 2 x 4 Input Exp Nand Gate	04713	MC830P	547150
A7U5	IC, 2 x 4 Input Exp Nand Gate	04713	MC830P	547150
A7U6 through A7U9	Not Used			
A7U10	IC, Mono Stable MV	01295	SN74121N	547142
A7U11	Photo Isolator	03911	CLI-3	547300
A7U12	IC, Hex Inverter	01295	MC836P	547155

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	Opt. P/N
A7U13	Not Used			
A7U14 through A7U16	IC, 4 x 2 Input Nand Gate	01295	MC846P	547152
A7U17 through A7U20	Not Used			
A7U21	IC, 4 x 2 Input Nand Pwr Gate	01295	MC858P	547161
A7U22	IC, 2 x 5 Input Nand Gate	01295	MC1800P	547158

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR. P/N	OPT. P/N
A8	Lo Sense Resistor Assembly	23405	908026	908026
A8R1	Res Fix MF: 1, .5%, 1ppm, .3W	18612	S102-M	503076
A9	Voltage Range Switching Board Assy.	23405	903109	903109
A9C1	Cap Fix Cer: 0.02mfd, 500V	56982	5GA-S20	522151
A9C2	Cap Var: 1-14pF, Piston	16509	TF14A	530021
A9C3	Optional, Selected Value			
A9C4	Cap Fix Tant: 10mfd, 20%, 35V (Sel)	05397	T362B107K035AS	524022
A9C5	Cap Fix Tant: 10mfd, 20%, 35V (Sel)	05397	T362B107K035AS	524022
A9C6	Cap Fix MPC: .22mfd, 10%, 200V	18489	PCMF224K2A	521059
A9C7	Cap Fix Cer: 0.0047mfd, 1KV	56289	5GA-D47	522145
A9CR1 through A9CR10	Diode: IN3064	07263	IN3064	543200
A9CR11	Diode: IN4005	04713	IN4005	543928
A9CR12	Diode: IN4005	04713	IN4005	543928
A9CR13 through A9CR28	Diode: IN3064	07263	IN3064	543200
A9K1 through A9K4	Relay: DPST 12V: Lo Thermal	71707	CR3202-12-501	015074
A9K5	Relay: DPDT 12V	09250	R2696-2	015049
A9K6	Relay: DPST 12V: Lo Thermal	71707	CR3206-12-501	015074
A9K7	Relay: DPST 12V: Lo Thermal	71707	CR3206-12-501	015074
A9K8	Relay: DPDT 12V: Lo Thermal	71707	CR3206-12-701	015073
A9K9	Relay: SPST 12V	09250	R2694-2	015033
A9R1	Res Fix MF: 10K, 1%, 1/8W	75042	RN55D	502291
A9R2	Res Fix MF: 15, 1%, ½W	75042	RN65D	502009
A9R3	Res Var: 20K, 10%, 20T	73138	66WR20K	511241
A9R4	Res Fix CC: 2.2, 5%, ½W	01121	EB2205	500024
A9R5	Res Fix MF: 4.1417K, 0.01%, 0.3W	18612	S102	503073
A9R6	Optional, Selected Value			
A9R7	Res Var: 100, 10%, 20T	73138	66WR100	511077
A9R8	Res Fix MF: 30K, 0.1%, 1W	18612	S106	503014
A9R9	Res Fix CC: Selected 6.2-8.2	01121	RC07	
A9R10	Res Fix CC: Selected Nom. 8.2	01121	RC07	
A9R11	Res Fix MF: 1M, 1%, ¼W	91637	MF-1/8	505060
A9R12	Res Fix MF: 20K, 1%, 1/8W	75042	RN55D	502351

TABLE 7-I (continued)

REF DESIG	DESCRIPTION	MFR. CODE	MFR. P/N	OPT. P/N
A10	100V Amplifier Board Assy.	23405	908021	908021
A10A1	Operational Amplifier	23405	547024	547024
A10C1	Cap Var: 37-250pF, 350V	72136	42-426	532060
A10C2	Cap Fix Cer: .01mfd, 1KV	56289	5GA-S10	522150
A10C3	Cap Factory Selected			
A10C4	Cap Fix Elect: 10mfd, 50V	14655	NLW10-50	525040
A10C5	Cap Fix Tant: 100mfd, 20V	05397	T362D107M020AS	524075
A10C6	Cap Fix Mica: 47pF, 500V	72136	DM15-470F	520047
A10C7	Not Used			
A10C8 through A10C11	Cap Fix Tant: 100mfd, 20V	05397	T362D107M020AS	524075
A10C12	Cap Fix Elect: 10mfd, 50V	14655	NLW10-50	525040
A10C13	Cap Var Cer: 5.5-18pF, NPO	72982	538-011A5.5-18	532032
A10C14	Cap Fix Elect: 1500mfd, 20V	37942	PWP060A	525302
A10C15	Not Used			
A10C16	Cap Fix Cer: 0.1mfd, 500V	56289	5HK-P10	522202
A10C17	Cap Fix Mica: 18pF, 500V	72136	DM15-180F	520035
A10C18	Cap Fix Cer: 22pF, 1KV, NPO	56289	10TCC-022	522050
A10C19A	Cap Fix Cer: .1mfd, 500V	56289	5HK-P10	522202
A10C19B	Cap Fix Cer: .1mfd, 500V	56289	5HK-P10	522202
A10CR1	Diode, Zener: 14V, 5%	04713	1N5244B	544109
A10CR2	Diode, Zener: 14V, 5%	04713	1N5244B	544109
A10CR3	Diode, Zener: 6.2V, 5%	01281	LVA62A	544014
A10CR4	Diode, Zener: 30V, 5%	04713	1N5256B	544057
A10CR5	Diode, Zener: 18V, 5%	04713	1N5248B	544053
A10CR6	Diode, Ref: 9.0V, 5%	04713	1N935	543040
A10CR7	Diode, Ref: 9.0V, 5%	04713	1N935	543040
A10CR8 through A10CR10	Diode, Ref: 11.7V, 5%	04713	1N941	544042
A10CR11	Diode, Ref: 9.0V, 5%	04713	1N935	543050
A10CR12	Diode, Ref: 9.0V, 5%	04713	1N935	543050
A10CR13	Diode, Bridge Rect: 25V	30857	WI10	545013
A10CR14	Diode: 1N3064	07263	1N3064	543200
A10Q1	Transistor: NPN 2N5249	03608	2N5249	540280
A10Q2	Transistor: NPN 2N3439	02735	2N3439	540119
A10Q3	Transistor: PNP 2N4890	04713	2N4890	540250
A10Q4	Transistor: PNP 2N5087	04713	2N5087	540275
A10Q5	Transistor: PNP 2N5422	02735	2N5422	540284
A10Q6	Transistor: PNP 2N5422	02735	2N5422	540284
A10Q7	Transistor: PNP 2N4890	04713	2N4890	540250
A10Q8	Transistor: NPN 2N3439	02735	2N3439	540119

TABLE 7-1 (continued)

REF DESIG.	DESCRIPTION	MFR. CODE	MFR. P/N	OPT. P/N
A10R1	Not Used			
A10R2A	Res Fix MF: 10K, 2%, 2W	28363	C42S	502374
A10R2B	Res Fix MF: 10K, 2%, 2W	28363	C42S	502374
A10R3	Res Var: 20K, 10%	73138	66WR20K	511241
A10R4	Res Fix MF: 200K, 1%, ½W	75042	RN65D	502580
A10R5	Res Fix MF: 2K, 1%, ¼W	75042	RN60D	502197
A10R6	Res Fix MF: 47K, 5%, 2W	28363	C42S	502466
A10R7	Res Fix MF: 24.9K, 1%, ¼W	75042	RN60D	502387
A10R8	Res Var: 50K, 10%	73138	66WR50K	511248
A10R9	Res Fix CC: 470, 5%, ¼W	01121	CB4715	500085
A10R10	Res Fix CC: 1.8K, 5%, ½W	01121	EB1825	500136
A10R11	Res Fix MF: 200, 1%, ½W	75042	RN65D	502036
A10R12	Res Fix MF: 2K, 1%, ¼W	75042	RN60D	502197
A10R13	Res Fix MF: 40.2K, 1%, ¼W	75042	RN60D	502438
A10R14	Res Fix MF: 2K, 1%, ¼W	75042	RN60D	502197
A10R15	Res Fix CC: 47, 5%, ¼W	01121	CB4705	500060
A10R16	Res Fix MF: 47K, 2%, 2W	28363	C42S	502466
A10R17	Res Fix CC: 100, 10%, ½W	01121	EB10110	500070
A10R18	Res Fix CC: 330, 5%, ½W	01121	EB3315	500077
A10R19	Res Fix CC: 75K, 5%, 1W	01121	GB7535	500267
A10R20	Res Var: 5K, 10%, 22T	73138	66WR5K	511184
A10R21	Res Fix CC: 100, 10%, ½W	01121	EB10110	500070
A10R22	Res Fix CC: 10, 5%, ½W	01121	EB0105	500031
A10R23	Res Fix CC: 10, 5%, ½W	01121	EB0105	500031
A10R24	Res Fix CC: 100, 10%, ½W	01121	EB10110	500070
A10R25	Res Fix CC: 100, 10%, ½W	01121	EB10110	500070
A10R26	Res Fix CC: 10, 5%, ½W	01121	EB0105	500031
A10R27	Res Fix CC: 10, 5%, ½W	01121	EB0105	500031
A10R28	Res Fix CC: 100, 10%, ½W	01121	EB10110	500070
A10R29	Res Fix CC: 100, 10%, ½W	01121	EB10110	500070
A10R30	Not Used			
A10R31	Not Used			
A10R32A	Res Fix MF: 20K, 2%, 2W	28363	C42S	502391
A10R32B	Res Fix MF: 20K, 2%, 2W	28363	C42S	502391
A10R33	Res Fix MF: 2K, 1%, ¼W	75042	RN60D	502197
A10R34	Res Fix CC: 1K, 10%, ½W	01121	EB10210	500120
A10R35A	Res Fix MF: 20K, 2%, 2W	28363	C42S	502391
A10R35B	Res Fix MF: 20K, 2%, 2W	28363	C42S	502391
A10R36	Not Used			
A10R37	Res Fix MF: 1.58K, 1%, ¼W	75042	RN65D	502164
A10R38 through A10R40	Not Used			
A10R41	Res Fix CC: 4.3K, 5%, ½W	01121	EB4325	500160
A10R42	Res Fix CC: 2.2K, 10%, ¼W	01121	CB22210	500141
A10R43	Res Fix CC: 47, 5%, ¼W	01121	CB4705	500060
A10R44	Res Fix CC: 1M, 5%, ½W	01121	EB1055	500361
A10R45	Res Fix CC: 51, 5%, ¼W	01121	EB5105	500052
A10R46	Res Fix CC: 1K, 5%, ¼W	01121	CB10210	500110
A10R47	Res Fix CC: 5.1K, 5%, ¼W	01121	CB0515	500027

TABLE 7-1 (continued)

REF DESIG.	DESCRIPTION	MFR. CODE	MFR. P/N	OPT. P/N
A10R48	Res Fix MF: 4.99K, 1%, ¼W	75042	RN60D	502261
A10R49	Res Var: 5K, 10%, 22T	73138	66WR5K	511184
A10R50	REs Fix MF: 24.9K, 1%, ¼W	75042	RN60D	502387
A11	DC Reference Supply	23405	903106	903106
A11C1	Cap Fix Cer: 33pF, NPO, 1KV	56289	10TCC-Q33	522058
A11C4	Cap Fix Poly: .001mfd, 5%, 500V	71590	CPR-1000J	523030
A11C5	Cap Fix Poly: .001mfd, 5%, 500V	71590	CPR-1000J	523030
A11C6	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A11C7	Cap Fix Tant: 10mfd, 35V	05397	T362C106M035AS	524022
A11CR1 through A11CR14	Diode, Sil, Signal	07263	IN3064	543200
A11Q1	Xstr, Sil Pwr, NPN	02735	2N3053	540080
A11Q2	Xstr, Sil Pwr, PNP	02735	2N4036	540193
A11R1	Res Fix WW: 342-420, ¼W, Lo Thermal	07088	EP21	
A11R2	Res Var Cer: 5K, 10%, ½W	73138	66WR5K	511184
A11R3	Res Fix MF: 2.80K, 1%, ¼W TO	75042	RN60D	505028
A11R4	Res Fix MF: 1.21K, .1%, .3W	18612	S102M	503070
A11R5	Res Fix MF: 29.4K, 1%, ¼W	75042	RN60D	502397
A11R6	Res Fix MF: 12.1K, 1%, 1/8W	75042	RN55D	502321
A11R7				
A11R8	Res Fix MF: 7.017K, .01%, .3W	18612	S102M	503075
A11R9	Res Fix MF: 5K, .01%, .3W	18612	S102M	503074
A11R10				
A11R11	Res Fix MF: 1M, 1%, ¼W, TO	91637	MF-1/8	505060
A11R12	Res Fix MF: 3.16K, 1%, ¼W, TO	91637	MF-1/8	505031
A11R13	Res Fix MF: 95.3K, 1%, ¼W, TO	91637	MF-1/8	505039
A11R14	Res Var Cer: 5K, 10%, ½W	73138	66WR5K	511184
A11R15	Res Fix MF: 12.1K, 1%, ¼W	75042	RN60D	502321
A11R16	Res Fix MF: 1K, 1%, ¼W, TO	75042	RN60D	502140
A11R17	Res Fix MF: 5K, .01%, .3W	18612	S102M	503074
A11R18	Res Fix MF: 5K, .01%, .3W	18612	S102M	503074
A11R19	Res Var Cer: 20K, 10%, ½W	73138	66WR20K	511241
A11R20	Res Fix MF: 1M, 1%, ¼W, TO	91637	MF-1/8	505060
A11R21	Res Fix MF: 2.43K, 1%, ¼W, TO	91636	MF-1/8	505022
A11R22	Res Fix MF: 200, 1%, ¼W, TO	91637	MF-1/8	505012
A11R23	Res Fix MF: 100, 1%, ¼W, TO	91637	MF-1/8	505059
A11R24	Res Fix CC: 10K, 5%, ¼W	01121	RC07	500200
A11R25	Res Fix MF: 100, 1%, ¼W	75042	RN60D	502059
A11R26	Res Fix CC: 10K, 5%, ¼W	01121	RC07	500200

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR. CODE	MFR. P/N	OPT. P/N
A1R27	Res Fix CC: 100, 5%, ¼W	01121	RC07	500069
A1R28	Res Fix CC: 3.3K, 5%, ¼W	01121	RC07	500149
A1R29	Res Fix CC: 3.3K, 5%, ¼W	01121	RC07	500149
A1R30	Res Fix CC: 3.3K, 5%, ¼W	01121	RC07	500149
A1R31	Res Fix WW: 100-300, .1%, ¼W	07088	Select In Test	507xxx
A1R32	Res Fix MF: 10.0-90.9, 1W, ¼W	91637	Select In Test	505xxx
A1R33	Res Fix CC: 1-9, 5%, ¼W	01121	Select h Test	500xxx
A1R34	Res Fix WW: 100, .1%, ¼W	07088	EP-21	507216
A1A1	Op Amp 8 Pin	27014	LM308H	547028
A1A2	Op Amp 8 Pin	06665	OP-07CJ	547033
A1A3	Op Amp 8 Pin	06665	OP-07CJ	547033
A1K1	Relay Reed DPST 12 VDC	34667	RR12-9212	015038
A1K2	Relay Reed SPST 12 VDC	34667	RR12-9112	015033
A1K3	Relay Reed DPST 12 VDC	34667	RR12-9212	015038
A1K4	Relay Reed DPDT 5-6 VDC	34667	RR12-8205	015013
A1K5	Relay Reed DPST 5-6 VDC	34667	RR12-9205	015012
A1K6	Relay Reed DPST 5-6 VDC	34677	RR12-9205	015012
A1U1	IC Quad 2 Input Pwr Gate	04713	MC858P	547161

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
C1	Cap Fix Elect: 12000mfd, 10V	56289	36D123G010AB2A	525452
C2	Cap Fix Elect: 12000mfd, 10V	56289	36D123G010AB2A	525452
C3	Cap Fix Elect: 1000mfd, 10V		9-65PSD1000-10A	525300
C4	Cap Fix Cer: 0.1mfd, 100V	72982	845-X5V-140Z	522200
C5	Cap Fix Cer: 0.1mfd, 100V	72982	845-X5V-140Z	522200
C6	Cap Fix Elect: 220mfd, 10V	06751	CS13BC227K	524100
C7	Not Used			
C8	Cap Fix Elect: 240mfd, 300V	56289	36D241F300AB2A	525176
C9	Cap Fix Elect: 240mfd, 300V	56289	36D241F300AB2A	525176
C10 through C13	Cap Fix Cer: 1000pF, 1KV	56289	5HK-D10	522140
C14	Cap Fix Tant: 10uF, 35V	05397	T362B107K035AS	524022
C15	Cap Fix Myl: 0.22mfd, 400V	56289	224P	521062
C16	Cap Fix Myl: 0.22mfd, 400V	56289	224P	521062
C17	Cap Fix Elect: 5000mfd, 10V	56289	39D508G010HP4	525401
C18	Cap Fix Tant: 10uF, 35V	05397	T362B107K035AS	524022
CR1	Diode, Bridge Rect: VS148	30857	VS148	545043
CR2	Not Used			
CR3	Not Used			
CR4	Diode: IN3064	07263	IN3064	543200
CR5	Diode: IN3064	07263	IN3064	543200
CR6	Not Used			
CR7	Diode, Bridge Rect: VS647	30857	VS647	545044
DS1 through DS4	Lamp: 10C7, 10W, DC Bay	24455	10C7DC	551150
DS5 through DS11	Lamp: Sub-Min.	05464	No. 66	551122
DS12 through DS15	Lamp: Sub-Min. 14V	71744	CM2182	551123
F1 through F3	Fuse: 1A, 125V, 3AG	75915	312001	570020
J1	Not Used			
J2A	Jack, Banana, Red	05276	2854R	000134
J2B	Jack, Banana, Black	05276	2854B	000133
J3	Connector: BNC	13511	UG-1094/U	000060
J4	Jack, Banana, Red	05276	2854R	000134
J5	Jack, Banana, Black	05276	2854B	000133
J6	Connector: Power 15A, 115V	83315	5240	000038

TABLE 7-1 (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT P/N
J7	Receptacle: A.C.	75382	227	000035
J8	Connector: Bulkhead, Twinax	05276	3580	000106
J9	Receptacle: 6 pin female	71785	S-306-DB	000006
J10	Receptacle: A.C.	75382	227	000035
J11 through J16	Not Used			
J17	Binding Post, Red, Lo Thermal	05276	3770	000108
J18	Binding Post, Black, Lo Thermal	05276	3770	000109
J19	Binding Post, Red, Lo Thermal	05276	3770	000108
J20	Binding Post, Black, Lo Thermal	05276	3770	000109
J21	Binding Post, Metal	83330	208	000112
L1	Inductor: 10 microhenry, 5%	99800	1537-36	562008
L2	Inductor: 100 microhenry, 5%	99800	1537-76	562040
L3	Inductor: 100 microhenry, 5%	99800	1537-76	562040
P1 through P8	Not Used			
P9	Plug: 6 Pin Male	71785	P306-CCT	000006
Q1	Transistor: MJ2941	04713	MJ2941	540292
Q2	Not Used			
Q3	Transistor: 2N4923	04713	2N4923	540262
Q4	Transistor: 2N4918	04713	2N4918	540260
Q5	Transistor: 2N4921	04713	2N4921	540261
Q6 through Q9	Transistor: TRS5006	34156	TRS5006	*540382
Q10 through Q13	Transistor: 2N3053	02735	2N3053	540080
R1	Res Fix CC: 220, 5%, ½W	01121	EB2215	500076
R2	Res Fix CC: 100, 5%, ½W	01121	EB1015	500070
R3	Res Var WW: 1K, 20%	71450	BK37047	511160
R4	Res Var Cer: 100, 10%	73138	78SR100	511059
R5	Res Var Cer: 100, 10%	73138	78SR100	511059
R6	Res Var WW: 50K, 5% 10T	02111	534-50K	513312
R7	Res Fix WW: 20K, 5%, 10W	09960	RH-10	507278
R8	Res Fix WW: 20K, 5%, 10W	09960	RH-10	507278
R9	Res Fix WW: 14K, 5%, 10W	09969	RH-10	507277
R10	Res Fix WW: 20K, 5%, 10W	09969	RH-10	507278
R11	Res Fix WW: 20K, 5%, 10W	09969	RH-10	507278
R12	Res Var: 2K, 2W, 10T	11534	3253R2KL.255L	513141
R13	Res Fix CC: 1, 5%, ¼W	01121	CB0105	500026
R14	Res Var: 2K, 2W, 10T	11534	3253R2KL.255L	513141

TABLE 7-I (continued)

REF DESIG	DESCRIPTION	MFR CODE	MFR P/N	OPT. P/N
R15	Res Var: 5K, 3%, 0.25%, LIN, 5T	02111	535-5K	513167
R16	Res Fix CC: 100K, 5%, 1W	01121	GB1045	500281
R17	Res Fix MF: Selected Value			
R18	Res Var: 50, 10%, 2W	44655	CU5001	510081
R19	Res Fix MF: 1.5K, 1%, ½W	75042	RN65D	502180
R20	Res Fix CC: 1, 5%, ¼W	01121	CB0105	500026
R21	Res Fix CC: 100K, 5%, 1W	01121	GB1045	500281
R22	Res Fix WW: 20K, 5%, 10W	09969	RH-10	507278
R23	Res Fix MF: 100, .1%, 1W	18612	S106	503012
R24	Res Fix CC: 100, 10%, ¼W	01121	CB1011O	500069
R25	Res Var WW: 50K, 5%, 10T	02111	534-50K	513312
R26	Res Var WW: 1K, 5%, 10T	02111	534-1K	513119
R27	Res Fix MF: 191K, 1%, ¼W	91637	MF-1/10	505050
R28	Res Fix MF: 200K, 1%, ½W	75042	RN60D	502579
S1 (R1R2)	1st Digit Switch Assy	23405	901238	901238
S2 (R3R4)	2nd Digit Switch Assy	23405	901253	901253
S3 (R5R6)	3rd Digit Switch Assy	23405	901264	901264
S4 through S9	Switch, Rotary, BCD 12 POS	11236	006134	006134
S10	Switch, Momentary - DC	82389	209W69-445	006300
S11	Switch, Momentary - +DC	82389	209W69-445	006300
S12	Switch, Momentary - Frequency	82389	209-W69-445	006300
S13 through S15	Switch, Momentary - Frequency	82389	209-W69-445	006300
S16 through S21	Switch, Gang - 6 STA	82389	209-W73-131	006307
S22 through S27	Switch, Momentary - Voltage	82389	209-W69-443	006302
S28	Switch, Toggle: SPDT	95146	MST-205N	006005
S29	Switch, Slide, DPDT	82389	46256LR	006054
S30	Switch, Slide: DPDT	82389	46256LF	006055
S31	Switch, Toggle: SPDT	95146	MST-205N	006005
T1	Transformer: Logic	81095	F26X	560116
T2	Transformer: Amplifier	21645		560295
T3	Transformer: Oscillator	21645	7016	560112
VR1	Voltage Regulator: LM309K	27014	LM309K	540394

TABLE 7-2. MANUFACTURERS CODE LISTING

00213	Sage Electronics Corp. Rochester, New York
00853	Sangamo Electric Co. Pickens, S.C.
01121	Allen Bradley Co. Milwaukee, Wisconsin
01281	TRW Semiconductors Lawndale, California
01295	Texas Instruments, Inc. Semiconductor Components Div. Dallas, Texas
01686	RCL Electronics, Inc. Manchester, New Hampshire
02111	Spectrol Electronics Corp. City of Industry, Calif.
02735	Radio Corp. of America Semiconductor Div. Somerville, N.J.
02777	Hopkins Engineering Co. San Fernando, Calif.
03508	General Electric Co. Semiconductor Products Syracuse, New York
03877	Transitron Electronic Corp. Wakefield, Mass.
03911	Clairex Corp. New York, New York
04713	Motorola Semiconductor Products, Inc. Phoenix, Arizona
05276	Pomona Electronics Pomona, Calif.
05397	Union Carbide Corp. Electronics Div. Cleveland, Ohio
05464	Industrial Electronic Engineers Van Nuys, Calif.
05820	Wakefield Engineering Ind. Wakefield, Mass.
06665	Precision Monolithics Santa Clara, Calif.
07088	Kelvin Electric Co. Van Nuys, Calif.
07263	Fairchild Semiconductor Div. of Fairchild Camera & Instrument Corp. Mountain View, Calif.
07397	Sylvania Elect. Prod. Inc. Mountain View, Calif.
07910	Teledyne Corp. (Continental Device) Hawthorne, Calif.
07933	Raytheon Mfg. Co. Semiconductor Mountain View, Calif.
08806	General Electric Co. Miniature Lamp Dept. Cleveland, Ohio
11236	CTS of Berne Berne, Indiana
11237	Chicago Telephone of Calif, Inc.(CTC) Paso Robles, Calif.
11711	General Instrument Corp. Semiconductor Div. Newark, N. J.
12040	National Semiconductor Corp. Danbury, Connecticut
12697	Clarostat Mfg. Co. Dover, New Hampshire
13103	Thermalloy Co. Dallas, Texas
13606	Sprague Electric Co. Transistor Div. Concord, New Hampshire

TABLE 7-2. MANUFACTURERS CODE LISTING (continued)

14193	California Resistor Corp. Santa Monica, Calif.
14655	Cornell-Dubilier Electronics Newark, N. J.
15636	Elec-Trol, Inc. Northridge, Calif.
16299	Corning Glass Raleigh, North Carolina
17850	Zeltex, Inc. Concord, Calif.
17856	Siliconix, Inc. Sunnyvale, Calif.
18324	Signetics Sunnyvale, Calif.
18489	Reliable Capacitors North Hollywood, Ca.
18612	Vishay Intertechnology, Inc. Malvern, Pennsylvania
18736	Voltronics Corp. Hanover, New Jersey
22767	ITT Semiconductors Div. of ITT Palo Alto, Calif.
23405	Optimation, Inc. Sun Valley, Calif.
24455	G. E. Lamp Div. Cleveland, Ohio
27014	National Semiconductor Corp. Santa Clara, Calif.
28480	Hewlett Packard Co. Palo Alto, Calif.
29083	Monsanta Co., Inc. Santa Clara, Calif.
34156	Semicoa Costa Mesa, Calif.
34667	Jenco Engineering Co. San Fernando, Calif.
37942	Mallory, P.R. & Co., Inc. Indianapolis, Indiana
44655	Ohmite Mfg. Co. Skokie, Illinois
53021	Sanamo Electric Co. Springfield, Illinois
56289	Sprague Electric Co. North Adams, Mass.
63743	Ward Leonard Electric Co. Mount Vernon, New York
70903	Belden Mfg. Co. Chicago, Illinois
71400	Bussmann Mfg. Div. of McGraw-Edison Co. Saint Louis, Missouri
71450	CTS Corp. Elkhart, Indiana
71590	Centralab Div. of Globe Union, Inc. Milwaukee, Wisconsin
71707	Coto Coil Co., Inc. Providence, Rhode Island
71744	Chicago Miniature Lamp Works Chicago, Illinois
71785	Cinch Mfg. Co. & Howard B. Jones Div. Chicago, Illinois
72136	ElectroMotive Mfg. Co. Willimantic, Connecticut
72699	General Instrument Corp. Cap. Div. Newark, New Jersey
72982	Erie Tech. Products, Inc. Erie, Pennsylvania

TABLE 7-2. MANUFACTURERS CODE LISTING (continued)

73138	Beckman Instruments, Inc. Helipot Division Fullerton, Calif.
73445	Amperex Electronic Corp. Hicksville, New York
73899	JFD Electronics Corp. Brooklyn, New York
75042	IRC, Inc. (Div. of TRW) Philadelphia, Pennsylvania
75915	Littlefuse, Inc. Des Plaines, Illinois
77342	Potter & Brumfield Div. of Amer. Machine & Foundry. Princeton, Indiana
77638	General Instrument Corp. Rectifier Div. Brooklyn, New York
78290	Struthers-Dunn, Inc. Pitman, New Jersey
78488	Stackpole Carbon Co. Saint Marys, Pennsylvania
80294	Bourns, Inc. Riverside, Calif.
80411	Acro Div. Robertshaw Controls Co. Columbus, Ohio
81073	Grayhill, Inc. LaGrange, Illinois
81095	Transformer Corp. Venice, Calif.
81483	International Rectifier Corp. Los Angeles, Calif.
82389	Switchcraft, Inc. Chicago, Illinois
82877	Rotron Mfg. Co., Inc. Woodstock, New York
83315	Hubbell Corp. Mundelein, Illinois
84970	Sarkes Trazian, Inc. Bloomington, Indiana
86684	Radio Corp. of America Electronic Components & Devices Harrison, New Jersey
87034	Marco-Oak, Inc. Anaheim, Calif.
87930	Tower Mfg. Corp. Providence, Rhode Island
88140	Cutler-Hammer, Inc. Lincoln, Illinois
90201	Mallory Capacitor Co. Indianapolis, Indiana
91146	ITT Cannon Elect. Inc. Salem, Mass.
91293	Johanson Mfg. Co. Boonton, New Jersey
91506	Augat Attleboro, Mass.
91637	Dale Electronics, Inc. Columbus, Nebraska
91662	Elco Corp. Willow Grove, Pennsylvania
93332	Sylvania Electric Products Semiconductor Products Div. Woburn, Mass.
94154	Tung-Sol Div. of Wagner Electric Corp. Newark, New Jersey
95023	Philbrick Researchers, Inc. Boston, Mass.

TABLE 7-2. MANUFACTURERS CODE LISTING (continued)

95146	Alco Electronics Products, Inc. Lawrence, Mass.
95275	Vitramon, Inc. Bridgeport, Connecticut
95303	Radio Corp. of America Solid State & Receiving Tube Div. Cincinnati, Ohio
96306	Microswitch Div. Minneapolis Honeywell Freeport, Illinois
97794	Yellow Springs Instrument Co. Yellow Springs, Ohio
99392	STM Oakland, Calif.
	Roderstein Germany

89791